

# CURRICULUM VITÆ

Grégory Soyez

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## Degrees

- Ph.D. in Physics from the University of Liège, with highest honors on January 6th, 2004.
- D.E.A. (5th year degree) in Physics from the University of Liège, with highest honors in 2002.
- License (4th year degree) in Physics from the University of Liège. First year with highest honors in 1998-99 and second year with highest honors in 1999-2000.
- Candidature (2nd year degree) in Mathematics from the University of Liège. First year with highest honors in 1996-97 and second year with highest honors in 1997-1998.
- Candidature (2nd year degree) in Physics from the University of Liège. First year with highest honors in 1996-97 and second year with highest honors in 1997-1998.

## Thesis and dissertations

- Ph.D. thesis: *Deep Inelastic Scattering at small  $x$ : Perturbative QCD and  $S$ -matrix theory.*
- Master dissertation: *The DGLAP equation: analytical properties and numerical resolution.*
- Undergraduate dissertation: *Light-cone quantisation, application to vacuum and zero modes.*

## Employment

- October 2007 - now: Postdoc position at the Brookhaven National Laboratory (Research Associate).
- October 2004 - September 2007: Postdoc position as a FNRS Research Fellow (Chargé de recherches). With this fellow, I have visited the following places:
  - October 2004 - October 2006: SPhT, CEA Saclay, France.
  - November 2006 - January 2007: LPTHE, University Paris VI/VII, France.
  - February 2007 - March 2007: GGI program, Firenze, Italy.
  - March 2007 - June 2007: BNL, New York, USA.

## Research interests

During my Ph.D., I have been working, under the supervision of Dr. J.R. Cudell, on the proton structure functions, especially on the small- $x$  region. The main aim of my work was to have a description of the experimental measurements coherent with the DGLAP equation at large  $Q^2$  and Regge theory at small- $x$ . I have also worked independently on the structure of the QCD vacuum, using light-cone quantisation.

As a Postdoc, I am studying saturation and fluctuation effects in perturbative high-energy QCD in collaboration with the SPhT at the CEA Saclay and the Nuclear Theory group at the Brookhaven National Laboratory. This field of research covers the structure QCD in its high-energy limit, its universal links with statistical physics and the applications to phenomenology.

Since two years I also work on jet physics with G. Salam and M. Cacciari. We have developed new algorithms (*e.g.* SIScone) and new analysis techniques (*e.g.* jet areas), both analytically and in their applications to jet physics at the LHC. This is an active field of research for me.

## General knowledge

- Quantum field theory, particle physics and gauge theories.
- Theoretical astrophysics, general relativity and cosmology.
- Group theory.
- Programming in C, C++, Pascal, Fortran, Java and Basic; 3D programming using OpenGL; multi-platform programming using wxWidgets.

## Miscellaneous distinctions

- Participation, with the Belgian team, to the 37th International Mathematical Olympiad, in 1996. Bronze medal.
- Roset Prize, given by the AMULg (Association of the Ulg Mathematicians) for the year 1996-97. That prize is granted each year to a student in Mathematical Sciences.

## Teaching experience

- Programming exercises for B.A. students in Chemical Sciences, in 1999-2000 (30 hours/year).
- Physics laboratories for the general physics course for 1<sup>st</sup> year students in Computer Sciences, in 2002-2003 (50 hours/year).
- Physics laboratories for the general physics course for 1<sup>st</sup> year students in Computer Sciences, in 2003-2004 (50 hours/year).

## Publication list:

### Regular articles:

1. M. Cacciari, J. Rojo, G. Salam and G. Soyez, *Quantifying the performance of jet definitions for kinematic reconstruction at the LHC*, arXiv:0810.1304.
2. S. Munier, G.P. Salam and G. Soyez, *Travelling waves and impact parameter correlations*, to appear in Phys. Rev. D, arXiv:0807.2870.
3. M. Cacciari, G.P. Salam and G.Soyez, *The anti- $k_t$  jet clustering algorithm*, JHEP 04 (2008) 063 [arXiv:0802.1189].
4. M. Cacciari, G.P. Salam and G.Soyez, *The catchment area of jets*, JHEP 04 (2008) 005 [arXiv: 0802.1188]
5. A. Dumitru, E. Iancu, L. Portugal, G. Soyez and D.N. Triantafyllopoulos, *Pomeron loop and running coupling effects in high energy QCD evolution*, JHEP **0708** (2007) 062 [arXiv:0706.2540].
6. G. Soyez, *Saturation QCD predictions with heavy quarks at HERA*, Phys. Lett. B **655** (2007) 32 [arXiv: 0705.3672].
7. Gavin P. Salam and Gregory Soyez, *A Practical Seedless Infrared-Safe Cone jet algorithm*, JHEP **0705** (2007) 086 [arXiv:0704.0292] (see also <http://projects.hepforge.org/siscone/>).
8. C. Marquet, R. Peschanski and G. Soyez *Exclusive vector meson production at HERA from QCD with saturation*, Phys. Rev. D **76** (2007) 034011 [arXiv:hep-ph/0702171].
9. J.T. de Santana Amaral, M.B. Gay Ducati, M.A. Betemps and G. Soyez,  *$\gamma^*p$  cross-section from the dipole model in momentum space*, Phys. Rev. D **76** (2007) 094018 [arXiv:hep-ph/0612091].

10. E. Iancu, J.T. de Santana Amaral, G. Soyez and D.N. Triantafyllopoulos, *One-dimensional model for QCD at high energy*, Nucl. Phys. A **786** (2007) 131 [arXiv:hep-ph/0611105].
11. F. Gelis, R. Peschanski, G. Soyez and L. Schoeffel, *Systematics of geometric scaling*, Phys. Lett. B **647** (2007) 376 [arXiv:hep-ph/0610435].
12. C. Marquet, G. Soyez and B. W. Xiao, *On the probability distribution of the stochastic saturation scale in QCD*, Phys. Lett. B **639** (2006) 635 [arXiv:hep-ph/0606233].
13. E. Iancu, C. Marquet and G. Soyez, *Forward gluon production in hadron hadron scattering with Pomeron loops*, Nucl. Phys. A **780** (2006) 52 [arXiv:hep-ph/0605174].
14. Y. Hatta, E. Iancu, C. Marquet, G. Soyez and D. N. Triantafyllopoulos, *Diffusive scaling and the high-energy limit of deep inelastic scattering in QCD at large  $N_c$*  Nucl. Phys. A **773** (2006) 95 [arXiv:hep-ph/0601150].
15. C. Marquet, R. Peschanski and G. Soyez, *Consequences of strong fluctuations on high-energy QCD evolution*, Phys. Rev. D **73** (2006) 114005 [arXiv:hep-ph/0512186].
16. E. Iancu, G. Soyez and D. N. Triantafyllopoulos, *On the probabilistic interpretation of the evolution equations with Pomeron loops in QCD*, Nucl. Phys. A **768** (2006) 194 [arXiv:hep-ph/0510094].
17. C. Marquet, R. Peschanski, G. Soyez and A. Bialas, *Traveling waves in discretized Balitsky-Kovchegov evolution*, Phys. Lett. B **633** (2006) 331 [arXiv:hep-ph/0509216].
18. C. Marquet, R. Peschanski and G. Soyez, *QCD traveling waves at non-asymptotic energies*, Phys. Lett. B **628** (2005) 239 [arXiv:hep-ph/0509074].
19. G. Soyez, *Fluctuations effects in high-energy evolution of QCD*, Phys. Rev. D **72** (2005) 016007 [arXiv:hep-ph/0504129].
20. C. Marquet and G. Soyez, *The Balitsky-Kovchegov equation in full momentum space*, Nucl. Phys. A **760** (2005) 208-222 [arXiv:hep-ph/0504080].
21. C. Marquet, R. Peschanski and G. Soyez, *Traveling waves and geometric scaling at nonzero momentum transfer*, Nucl. Phys. A **756** (2005) 399-418 [arXiv:hep-ph/0502020].
22. G. Soyez, *Global QCD fit from  $Q^2 = 0$  to  $Q^2 = 3000 \text{ GeV}^2$  with Regge-compatible initial condition*, Phys. Rev. D **71** (2005) 076001 [arXiv:hep-ph/0407098].
23. G. Soyez *Small- $Q^2$  extension of the DGLAP-constrained Regge residues*, Phys. Lett. B **603** (2004) 189-194 [arXiv:hep-ph/0401177].
24. G. Soyez, *Regge residues from DGLAP evolution*, Phys. Rev. D **69** (2004) 096005 [arXiv:hep-ph/0306113].
25. J.R. Cudell, E. Martynov and G. Soyez,  *$t$ -channel unitarity and photon cross-sections*, Nucl. Phys. B **682** (2004) 391-420 [arXiv:hep-ph/0207196].
26. H. J. Pirner, A. I. Shoshi and G. Soyez,  *$\log(1/x)$  gluon distribution and structure functions in the loop-loop correlation model*, Eur. Phys. J. C **33** (2004) 63-74 [arXiv:hep-ph/0309155].
27. H. Caps, H. Decauwer, M-L. Chevalier, G. Soyez, M. Ausloos and N. Vandewalle, *Foam imbibition in microgravity*, Eur. Phys. J. B **33** (2003) 115-119 [arXiv:cond-mat/0108367].
28. G. Soyez, *DGLAP evolution extends the triple pole pomeron fit*, Phys. Rev. D **67** (2003) 076001 [arXiv:hep-ph/0211361].
29. J-R. Cudell and G. Soyez, *Does  $F_2$  need a hard pomeron*, Phys. Lett. B **516** (2001) 77-84 [arXiv:hep-ph/0106307].
30. G. Soyez, *Model for  $SU(3)$  vacuum degeneracy using light-cone coordinates*, Phys. Rev. D **63** (2001) 105012 [arXiv:hep-th/0101072].

Conference proceedings:

31. Grégory Soyez, *The SISCone and anti- $k_t$  jet algorithms*, DIS 2008, UCL, London, England, arXiv:0807.0021.
32. Grégory Soyez, *The Dipole picture in DIS: Saturation and heavy quarks*, DIS 2008, UCL, London, England, arXiv:0807.0020.
33. C. Buttar *et al.*, *Standard Model Handles and Candles Working Group: Tools and Jets Summary Report*, Les-Houches working group summary, arXiv:0803.0678.
34. J.T. de Santana Amaral, M.A. Betemps, M.B. Gay Ducati and G. Soyez, *The dipole-proton amplitude in momentum space*, 10th International Workshop on Hadron Physics, Florianopolis, Brazil, Int. J. Mod. Phys. **E16** (2007) 2818.
35. J.T. de Santana Amaral, M.A. Betemps, M.B. Gay Ducati and G. Soyez, *BK equation and traveling wave solutions*, 1st Latin American Workshop on High Energy Phenomenology, Porto Alegre, Brazil, Braz. J. Phys. **37** (2007) 648.
36. R. Peschanski, C. Marquet and G. Soyez, *Non-forward Balitsky-Kovchegov equation and vector mesons*, DIS 2007, Munich, Germany, [arXiv:0706.1446 (hep-ph)].
37. G. Soyez, *QCD at high energy: saturation and fluctuation effects*, 46th Cracow School of Theoretical Physics, Zakopane, Poland, Acta Phys. Polon. B **37** (2006) 3477 [arXiv:hep-ph/0610436].
38. G. Soyez, *From QCD at high energy to statistical physics and back*, DIS 2006, Tsukuba, Japan [arXiv:hep-ph/0606229].
39. G. Soyez, *Saturation in high-energy QCD*, ENFPC 2005, Sao Lourenco, Brazil [arXiv:hep-ph/0605192].
40. G. Soyez, *Fluctuation effects in high-energy QCD*, EDS 2005, Blois, France [arXiv:hep-ph/0509138].
41. G. Soyez, C. Marquet and R. Peschanski, *Geometric scaling in high-energy QCD at nonzero momentum transfer*, 40th rencontres de Moriond, La Thuile, Italy [arXiv:hep-ph/0504117].
42. G. Soyez, *New insight in global QCD fits using Regge theory*, HLPR 2004, Liège, Belgium, AIP Conf.Proc.**775** (2005) 88-96 [arXiv:hep-ph/0502158].
43. G. Soyez, *The triple-pole pomeron: Regge theory and DGLAP evolution*, DIS 2003, St-Petersburg, Russia [arXiv:hep-ph/0310230].
44. E. Martynov, J. R. Cudell and G. Soyez, *Consequences of  $t$ -channel unitarity for the interaction of real and virtual photons at high energies*, Diffraction 2002, Alushta, Ukraine [arXiv:hep-ph/0211448].
45. J. R. Cudell, E. Martynov and G. Soyez, *Consequences of  $t$ -channel unitarity for  $\gamma^{(*)}p$  and  $\gamma^{(*)}\gamma^{(*)}$  amplitudes*, ICHEP 2002, Amsterdam, The Netherlands [arXiv:hep-ph/0209281].

Works in preparation:

46. G. Soyez, *Update of the dipole model for exclusive processes in DIS*.
47. M. Cacciari, J. Rojo, G. Salam and G. Soyez, *Defining jets in heavy-ion collisions*.
48. M. Cacciari, G. Salam and G. Soyez, *The FastJet jet package: reference manual*.
49. G. Soyez, *Universal properties of travelling waves with running coupling*.

## Conferences and collaborations

### Seminars:

- *Recent progress in defining jets*, October 14 2008, ULg, Liège, Belgium.
- *Optimizing jet finding in pp and AA collisions*, August 14 2008, BNL, Upton NY, USA.
- *The FastJet jet package*, July 1 2008, Yale, USA.
- *An overview of saturation in QCD*, February 21 2008, ULg, Liège, Belgium (blackboard lecture).
- *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, February 18 2008, IIHE, ULB/VUB, Brussels, Belgium.
- *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, February 14 2008, UCL, Louvain-la-Neuve, Belgium.
- *An overview of saturation in QCD*, February 13 2008, ULB, Brussels, Belgium (blackboard lecture).
- *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, February 12 2008, UMH, Mons, Belgium.
- *New tools in jet physics: SISCone (a new cone algorithm) - jet areas (a new concept)*, October 31 2007, Fermilab, Batavia IL, USA.
- *QCD saturation phenomenology: geometric scaling at HERA*, October 11 2007, BNL, Upton NY, USA.
- *SISCone: a Seedless Infrared-Safe Cone algorithm*, August 8 2007, ULg, Liège, Belgium.
- *SISCone: a Seedless Infrared-Safe Cone algorithm*, June 12 2007, BNL, Upton NY, USA.
- *Saturation in High-energy QCD: scaling laws and phenomenological applications*, December 1 2006, VUB, Brussels, Belgium.
- *Saturation in High-energy QCD: scaling laws and phenomenological applications*, November 30 2006, UCL, Louvain, Belgium.
- *Saturation in High-energy QCD: scaling laws and phenomenological applications*, October 13 2006, CERN, Geneva, Switzerland.
- *High-Energy QCD: saturation and fluctuation effects*, April 10 2006, KEK, Tsukuba, Japan.
- *Saturation in High-energy QCD*, December 16 2005, ULg, Liège, Belgium.
- *Geometric scaling in High-Energy QCD*, November 23 2005, SPhT, CEA Saclay, Paris, France.
- *Saturation in High-energy QCD*, November 4 2005, ECT\*, Trento, Italy.
- *Saturation in High-energy QCD*, October 12 2005, UFRGS, Porto Alegre, Brasil.
- *Geometric scaling in High-energy QCD: nonzero momentum transfer and fluctuation effects*, June 23 2005, LPT, Université de Paris Sud, Orsay, France.
- *Geometric scaling in High-energy QCD*, April 20 2005, ULg, Liège, Belgium.
- *New insight in global QCD fits using Regge theory*, March 31 2005, LPTHE, Paris, France.
- *New insight in global QCD fits using Regge theory*, January 20 2005, Ecole Polytechnique, Palaiseau, France.
- *Deep Inelastic Scattering at small x: Perturbative QCD and S-matrix theory*, May 28 2004, IIHE, ULB, Brussels, Belgium.
- *The QCD factorisation theorem and DGLAP evolution*, 2003, ULg, Liège, Belgium.
- *S-matrix theory: introduction and application to DIS*, 2001, ULg, Liège, Belgium.
- *Light-cone quantisation: the vacuum problem*, 2000, ULg, Liège, Belgium.

### Conferences:

- New trends in HERA physics, October 5-10 2008, Ringberg Castle, Tegernesee, Germany.
- Initial conditions in heavy-ion collisions, September 1-19 2008, Goa, India.
- HERA/LHC workshop, May 26-30 2008, CERN, Geneva, Switzerland.
- Deep Inelastic Scattering 2008 (DIS 08), April 7-11 2008, UCL, London, UK.
- Workshop on Electron-Ion Collider (EIC), December 7-8 2007, Stony Brook, USA.
- Workshop on low- $x$  physics (Low- $x$  2007), August 29 - September 1 2007, Helsinki, Finland.
- HERA/LHC workshop, March 12-16 2007, DESY, Hamburg, Germany.
- QCD at high energy, January 8-12 2007, ECT\*, Trento, Italy.
- GGI program on QCD at high energy and high density, February 5 - March 9 2007, Firenze, Italy.
- Workshop on low- $x$  physics (Low- $x$  2006), June 28 - July 1 - 2006, Lisbon, Portugal.
- Cracow School of Theoretical Physics, XLVI Course, May 27 - June 5 2006, Zakopane, Poland.
- Deep Inelastic Scattering 2006 (DIS 06), April 20-24 2006, Tsukuba, Japan.
- Rencontre de Physique des Particules (RPP 06), Mars 1-3 2006, Paris, France.
- Brazilian particle and field meeting, October 4-7 2005, Sao Laurencio, Brasil. (1 hour talk as an invited speaker)
- Workshop on low- $x$  physics (Low- $x$  2005), June 29 - July 2 2005, Sinaia, Romania.
- Conference on Elastic and Diffractive Scattering (EDS05), May 15-20 2005, Blois, France.
- 40th Rencontres de Moriond on QCD and High Energy Hadronic Interactions, March 12-19 2005, La Thuile, Aosta Valley, Italy.
- Workshop on low- $x$  physics (Low- $x$  2004), September 14-17 2004, Prague, Czeck Republic.
- Diffraction at the LHC 2004, March 31-April 2 2004, Rio de Janeiro, Brasil. (Introduction and regulary talks given)
- Workshop on low- $x$  physics (Low- $x$  2003), June 3-6 2003, Nafplio, Greece.
- Deep Inelastic Scattering 2003 (DIS 03), April 23-27 2003, St Petersburg, Russia.
- Meeting Heidelberg-Saclay-Rostock-Liège, December 19-21 2002, Ladenburg, Germany.
- Workshop on low- $x$  physics (Low- $x$  2002), September 16-19 2002, Antwerp, Belgium.
- NATO Advanced Study Summer School on high-density QCD, August 6-18 2001, Cargèse, Corsica.
- CTEQ 2000 Summer School, June 17-26 2001, St Andrews, Scotland.

### Collaborative visits:

- Work with K. Itakura, 10-19 April 2006, KEK, Tsukuba, Japan.
- Work with J-P. Blaizot, 1-11 November 2005, ECT\*, Trento, Italy.
- Work with R. Peschanski, 3-9 June 2004, Saclay, France.
- Work with H.J. Pirner and A.I. Shoshi, 5-10 May 2003, Heidelberg, Germany.