

# Collider physics, the group:

## Staff members

Claude Duhr (to start soon ...)

Stefano Frixione

Michelangelo Mangano

Gavin Salam (*will arrive in LH tomorrow morning*)

Giulia Zanderighi

## Fellows

Simone Alioli (2014)

Simon Badger (2013)

Valerio Bertone (2013, ERC)

Fabrizio Caola (2014)

Rikkert Frederix (2012)

Benjamin Fuks (2012)

Hendrik Mantler (2013)

Andreas Papaefstathiou (2014, MC)

Sebastian Sapeta (2013)

Markus Schulze (2013)

Hua-Sheng Shao (2014, ERC)

Andrzej Siodmok (2014, *could not come to LH*)

## Not present in LH:

## Paid Scientific Associates:

Ulrich Haisch

Roberto Pittau

## Students

Alice Donati

Ben Page

**Common thread of the groups' activities:**

**ACCURATE DESCRIPTION OF LHC DYNAMICS,  
AND IMPLICATIONS FOR THE  
INTERPRETATION OF THE LHC DATA**

*This covers fundamental theoretical progress at the QFT level, as well as the development of tools for the modeling of LHC processes, and for the description of backgrounds to BSM phenomena, the accurate determination of SM parameters (e.g.  $M_W$  or  $M_{top}$ ), the optimal extraction of signatures, etc.etc.etc.*

**Dynamical aspects of LHC physics are relevant to both SM and BSM phenomena, and rest on 3 pillars**

**DESCRIPTION OF THE PROTON STRUCTURE IN TERMS OF QUARKS AND GLUONS, AT ALL  $Q^2$  SCALES**

**DESCRIPTION OF THE HARD SCATTERING PRODUCTION (AND DECAY) PROCESSES, VIA PERTURBATIVE EXPANSION**

**DESCRIPTION OF THE EVOLUTION TOWARDS A PHYSICAL, OBSERVABLE STATE, OF THE PARTONS PRODUCED IN THE HARD SCATTERING**

***ALL THESE TOPICS ARE COVERED IN DEPTH BY THE ACTIVITIES OF OUR GROUP***

## RECENT PROGRESS AND CHALLENGES

*DESCRIPTION OF THE PROTON STRUCTURE IN TERMS OF QUARKS AND GLUONS, AT ALL  $Q^2$  SCALES*

- Inclusion of LHC data into the PDF fits
- Incorporate effects of shower evolution in the modeling of processes used for PDF fits
- Coherent NNLO extraction of PDF parameterizations
- Need to account for effects of QED evolution (needed precision implies we can no longer neglect the presence of photons inside the proton)

## RECENT PROGRESS AND CHALLENGES

*DESCRIPTION OF THE HARD SCATTERING ...*

- NLO done and automatized for almost everything of current interest
- NLO for procs which are 1-loop already at LO
- NLO in EW and BSM
- NNLO for many H procs, gauge boson pairs, ttbar
- NNLO to be completed for inclusive jets
- Further progress required to complete NNLO for many important processes (e.g. ttH), and to automatize
- NNNLO approaching for inclusive H production
- ... how far can one go ? practical issues, and of principle ....

## RECENT PROGRESS AND CHALLENGES

*DESCRIPTION OF THE EVOLUTION TOWARDS PHYSICAL FINAL STATES (HADRONIZATION, ETC ...)*

- NLO+parton shower evolving towards NNLO+parton shower
- Shower description limited still to (N)LL accuracy
- Great improvement in modeling of non-PT effects, due to feedback from LHC data
- Incontrovertible evidence that multiparton scattering processes are necessary to model pp collisions
- Implications for cosmic ray physics, interpretation of highest-energy data

# Group activities

- Collider Cross Talk (Thursday at 11am)
- Friday QCD lunch (convene at 12:45)
- Friday seminar

# Other activities of relevance to LHC physics



## LPCC links

### WELCOME

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### LHC WORKING GROUPS

[MB & UE WG](#)

[Electroweak WG](#)

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### EVENTS

[Forthcoming events](#)

[Past events](#)

### LHC PUBLICATIONS

### STUDENTS RESOURCES

### MISC

## Useful links

[CERN](#)

[LHC & expts](#)

[LHC centres in other Labs](#)

[HEP](#)

## Latest LHC data publications [\(full list\)](#)

### ALICE

Production of inclusive  $\Upsilon(1S)$  and  $\Upsilon(2S)$  in p-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV,  
<http://arxiv.org/abs/1410.2234>.

Event-by-event mean pT fluctuations in pp and Pb-Pb collisions at the LHC,  
<http://arxiv.org/abs/1410.2234>

## News

### 2015 CERN - Latin-American School of High-Energy Physics

10/16/2014

The school will be held in Ibarra, Ecuador from 4 to 17 March 2015. PLEASE NOTE THAT THE DEADLINE FOR APPLICATIONS IS 14 NOVEMBER 2014. The lectures will cover a broad range of HEP topics at a level suitable for students working for a PhD in experimental particle physics (although MSc students and postdocs may also apply). Note that financial support may be available for Latin-American students attending the School. Although the School is targeted particularly at students from Latin-American countries, it is open to self-funding students coming from other regions. Details can be found from:

<http://cern.ch/PhysicSchool/CLASHEP/CLASHEP2015/>

[Read More...](#)

### MC PLOTS release

02/17/2011

**MC PLOTS** is a new cern-based website for Monte Carlo comparisons, intended as a simple browsable repository of plots comparing HEP event generators to a wide variety of available experimental data, mainly based on the RIVET analysis tool.

For more details:

[Read More...](#)

## Forthcoming events

### Next 2 weeks

#### Quarkonium 2014

11/10/2014 || 14:00 => 11/14/2014 || 18:00

10th edition of the International Workshop on Heavy Quarkonium. November 11-14, Filtration Plant.

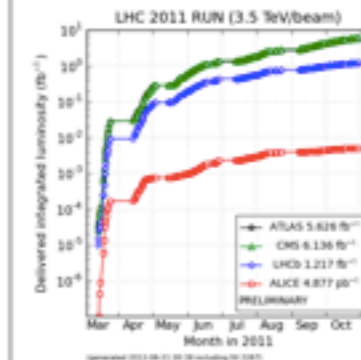
<http://indico.cern.ch/event/278195/>

## Status of LHC ops

### SHUTDOWN

[LHC programme coordination](#)

LHC integrated luminosity from 2011-2012 runs [charts](#)



## Coming events at CERN

*Conferences & Workshops, 05/11, 12h - CERN Theory Group Retreat 2014 by Mangano, Michelangelo & Lerche, Wolfgang*

*TH Theoretical Seminar, 05/11, 14h - no seminar (TH retreat)*

*Collider Cross Talk, 06/11, 11h - TH retreat (no Cross talk)*

*LPCC Workshops, 10/11, 8h - Quarkonium 2014 by Mangano, Michelangelo*

*EP Seminar, 11/11, 11h - Celebrating Quarkonium: The First Forty Years by Quigg, Chris*

*Academic Training Lecture Regular Programme, 12/11, 11h - LHC Beam Instrumentation: Beam Position and Intensity Measurements (1/3) by Jones, Rhodri*

*TH Theoretical Seminar, 12/11, 14h - Signals from Natural SUSY by Delgado, Antonio*

*Academic Training Lecture*



# Other activities of relevance to collider physics

- Future Circular Colliders:
  - $e^+e^-$
  - pp
  - ep
  - heavy ions

Activities documented on

<http://indico.cern.ch/category/5258/>

Join mailing list for announcements:

[http://cern.ch/simba3/SelfSubscription.aspx?  
groupName=fcc-experiments-hadron](http://cern.ch/simba3/SelfSubscription.aspx?groupName=fcc-experiments-hadron)

FCC-hh BSM group, workplan discussion,  
<http://indico.cern.ch/event/345676/>

November 24:

FCC-hh Higgs and EWSB group, workplan discussion,  
<http://indico.cern.ch/event/348468/>