



# Les Houches Workshop Series

## == Physics at TeV Colliders ==

### 2019 Session : 10 to 28 June

LES HOUCHES



## Introduction and Welcome The Organisers

# SESSION II



**11th PhysTeV Les Houches**

**20 years of PhysTeV Les Houches**

**started in 1999**

# LH PHYSTEVT THROUGH THE YEARS

In 1999 about 65 participants over 12 days, 1 session

2001 -> 85, 12 days

2003 → ~100 12 days

2005, 2 sessions 170 people, 3 weeks


2007, more than 300 applications! could not accommodate everyone, two sites,

2009 about the same as in 2007! One site: The Centre

2011  2017: about 250 applications as in 2015 imbalance between session 1 and session 2

**2019 increase in applications. More balance between session 1 and session 2**

# Aim and Format of the Workshop

|                          |   |
|--------------------------|---|
| Les Houches 2019         | <a href="#">Home</a>  |
| Working Groups           | Les Houches PhysTeV Series   |
| Wiki                     |   |
| Topics for Consideration | This series of <b>Workshops</b> aims at <b>bringing together theorists and experimentalists</b> working on the phenomenology of the <b>TeV colliders</b> with an emphasis on the physics at the <b>LHC</b> . The Workshops have also been a forum for the physics at the <b>Tevatron</b> , <b>HERA</b> and the <b>Linear Collider</b> . The series gives as much attention to progress in new techniques for the simulation of Standard Model processes as well as to the latest developments concerning new mechanisms of symmetry breaking and the New Physics. With the discovery of a Higgs-like signal in July 2012 this aspect takes on a whole new perspective. The interdependence between the signals from the New Physics and their respective backgrounds has always been stressed. Studies are conducted within 3 to 4 Working Groups covering these various aspects of collider physics. In addition an inter-group dedicated to <b>Tools and Monte Carlos</b> is set up. This inter-group liaises with all WG with the task of incorporating some of the issues and new techniques developed in these groups in view of improving Monte Carlos and setting <b>standards and accords</b> among the simulation codes to better meet the experimental needs. |
| Programme in LH          |   |
| Registration             |   |
| Organising Committees    | One of the most appreciated originality of the Workshop is that it runs over a whole year with the <b>meeting in Les Houches</b> , usually in May or June for 2 or 3 weeks, being the central point of the Workshop. In addition to the Working Group activities, a few lectures and review talks are planned. <b>Most of the time is dedicated to collaborations, intense discussions and brain storming</b> . Talks by participants are kept to a minimum unless they are informal presentations in the discussion groups.  |
| Poster PhysTeV 2019      |   |
| Practical Info           | Due to space limitation in Les Houches, <b>attendance to the meeting is limited to 70</b> participants at any given point.  |
| Contact, Secretariat     | <a href="#">Les Houches School for Physics</a> is located in the French Alps, about an hour from Geneva and an hour from Annecy. The School has a tradition of organising Schools, Workshops and Conferences for more than five decades now and boasts an excellent library. For the purpose of this Workshop a special computing system is installed.  |
| LH PhysTeV Series        |   |
| Freeman Dyson in LH      |   |
| Previous Sessions        |   |

## Session 2: 19-28 June 2019

The discovery of a Higgs-like signal at the LHC will be at the centre of the work and discussions in this session. Among the topics to be reviewed is the role of naturalness for example. Another issue is the impact of the discovered scalar on scenarios of Beyond-the-SM physics. Connected to searches for New Physics is in turn the issue of how to present the data. Other topics relate to flavour physics and Dark Matter. **The list of topics will be updated on the wiki.**

### Higgs: New Physics

#### Theory

A. Falkowski, LPT Orsay, France

J. M. No, Madrid, Spain

Tevong You, DAMTP, Cambridge, UK

#### Experiment

A. Gilbert (CMS), CERN, Switzerland

W. J. Murray (ATLAS), Warwick, UK

### BSM: Beyond the SM

#### Theory

M. Nardecchia, INFN SISSA, Trieste, Italy

R. Torre, CERN, Switzerland and INFN Genova, Italy

#### Experiment

G. Brooijmans (ATLAS), Columbia University, USA.

G. Zevi Della Porta (CMS), UC San Diego, USA.

### Tools and Monte-Carlos

#### Theory

B. Fuks, LPTHE, Paris, France

#### Experiment

A. Buckley (ATLAS), Glasgow Univ., UK

#### Machine Learning and Artificial Intelligence

S. Caron, Nikhef, Amsterdam, The Netherlands

# Les Houches Higgs Working Group

- ♦ Les Houches Higgs Working Group
  - ♦ SM Issues (Session 1)
  - ♦ Higgs: new physics. Session 2

## List of Participants (Access restricted to registered participants)

- Present in Les Houches in session 1
- Present in Les Houches in session 2
- The Global List including all registered participants for the Higgs

## List of Topics

### To be updated

### SM Issues (Session 1)

- Parton shower and underlying event related systematics in Higgs measurements for signal and background (together with Loops, Multilegs, Jets)
- Prospect of quark/gluon jet tagging for VBF (synergy with Jets session)
- Predictions+uncertainty models for backgrounds to ttH production: tt+HF, ggH+HF, tt+V
- Background function choice for  $H \rightarrow \text{gamgam}$  and  $H \rightarrow \text{mumu}$ : how to evaluate the functional choice systematics
- STXS:
  - Brainstorming on “STXS for Higgs decays” or something similar for decay property measurements
  - Updates on STXS for production
- Probing Higgs Width and Top Quark Yukawa Coupling from ttH and tttt
- Higgs pair production and self-coupling observables, top quark mass-scheme uncertainties
- EFT description of Higgs production

### Higgs: new physics. Session 2

- Higgs pairs:  $\lambda_{HHH}$  from single & double;
- Natural Higgs alignment, low upper limits on new Higgs masses, and non-SM multi-H couplings in the Gildener-Weinberg scheme.
- VBF Higgs pairs:  $C_{2v}$ ,  $C_v$  relation
- Rare decays: benchmark for  $H \rightarrow \text{aa} \rightarrow \text{gamgamgamgam}$
- Rare and exotic Higgs decays: further channels not searched for? motivation in specific BSM scenarios?
- CP violation and Higgs: (HL-)LHC sensitivity, complementarity with other probes (e.g. EDMs)
- Lighter than 125 GeV scalars: how well are they covered by LHC and LEP?
- Interpretation of SM coupling/STXS constraints in BSM benchmarks
- MSSM: how to close the gap in the high  $m_A$  ( $\geq 500$  GeV), intermediate  $\tan(\beta)$  range?
- Precision measurements to sharpen interpretation of Higgs results (W mass, TGCs, W/Z coupling to quarks, CKM ...)
- New physics at the high-energy tail of Higgs distributions

# **Les Houches Spirit?**

# LES HOUCHES SPIRIT IN ACTION

WHEN NOT RAINING



- Avoid succession of formal, *normal* talks





# CONTINUES EVEN IN THE BAR



GRASS IS BACK  
AND CUT



# A LES HOUCHES ACCORD

IN THE MAKING IN

THE BAR



DM LH NON ACCORD !!

# **LH Accords, Discords, Proposals, Wishlists**

# The *(original)* Les Houches Accords



## HepUP Event Record

- Successful!
  - ⊗ Majority of MC talks at Les Houches mention it.
  - ⊗ Every ME/PS project that I've heard discussed in last 12 months uses it.
- Should extra info for ME/PS be included?
  - ⊗ No: generic information content is not yet established, everyone is trying new/different things. Still need max. freedom.
- Requests for a specified file format, -- but fear that forcing such a format would limit users.
  - ⊗ Tevatron uses FNAL MCFIO
  - ⊗ CERN MCDB using XML-like text files.

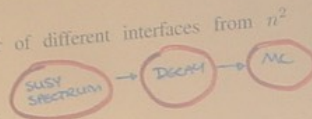
## LHAPDF (structure functions)

- fewer users.
- evolves PDFs ... no long lookup tables
- Includes code==maintenance
  - ⊗ To be moved to Durham, maintained by Mike Whalley
- To do:
  - ⊗ Need to allow possibility of having many PDFs in memory at one time, to facilitate use of PDFs with uncertainties.
  - ⊗ Need access to:
    - $\Lambda_s$ ,  $\Lambda_Q$ ,  $c_{\text{threshold}}$ ,  $b_{\text{threshold}}$ ,  $Q_{\text{min}}$ ,  $x_{\text{min}}$
  - ⊗ allow for  $p \rightarrow \gamma$  (need to include evolution)
  - ⊗ and other beam particles,  $\pi$ , ...
  - ⊗ Other smaller changes.
    - Map author strings onto integer
  - ⊗ Try to make everything backwards compatible.
- J. Huston to coordinate.

OLAS  
Les Houches 2001

# Les Houches Discord

- Les Houches 2001 accord between matrix element generators, Monte-Carlo programs
- Idea is to set same thing up between SUSY spectrum generators and other programs (co-ordinator: P Skands)
- Reduces number of different interfaces from  $n^2$  problem to  $n$
- long discussions
- At Les Houches 2003, then implemented one simple case (CMSSM); it **threw up** problems in the interface design
- Design principles: general structure which can be extended, conventions for particular case etc., higher loops very thorny



Homepage: <http://allanach.com/~ernst/allanach/>



JUN 6 2003

# PROGRAMME

Programme and Planning updated daily, **CONSULT** the Wiki and  
do the Wiki, Wiki

## Les Houches 2019 New Physics Working Group

List of participants (Accessed restricted to registered participants)

- Present in Les Houches in session 2
- The Global List including all registered participants for BSM

To be updated

- **Precision physics at the LHC**
  - Precision measurements of Z and W couplings to quarks
  - Lepton flavor violation in W decays
  - Measurement of CKM elements
  - High-energy tail of Drell-Yan production
- **New Physics**
  - VLQs beyond V/Hq decays
  - Unconventional signatures
  - Complex DM and colliders
- **Flavour anomalies**
  - High pT searches connected with the flavour anomalies
  - Optimized leptoquark and Z' searches
  - Tail of the di-leptons distributions
  - ...
- **BSM and Machine Learning**
  - Determination of model parameters





# Les Houches Spirit





## Les Houches Spirit



# PROGRAMME

Programme and Planning updated daily, **see also the board in the entrance hall, outside the auditorium**



# WIKI

All of you have an account

start

## Login

You are currently not logged in! Enter your authentication credentials below to log in. You need to have cookies enabled to log in.

**Login**

Username

Password

Remember me

Login

Forgotten your password? Get a new one: [Set new password](#)



start

boudjema

## Send new password

Please enter your user name in the form below to request a new password for your account in this wiki. A confirmation link will be sent to your registered email address.

**Set new password for**

Username

Set new password



# Media Manager

Namespaces    Media Files    Upload    Search

Choose namespace    Files in **2019:groups**    Thumbnails    Rows    A-Z    Name    Date

- [-] [root]
- + 2013
- + 2015
- + 2017
- [-] 2019
  - + conveners
  - [-] **groups**
    - + conv\_org\_talks
    - + session1
    - + session1\_higgs
    - + session1\_toolsan
    - dmc
    - + session2\_bsm
    - + session2\_higgs
    - + session2\_toolsan

Nothing was found.



**Use the mailing lists**

**Main Hall**



**QCD Room**



**Library (Cosy)**



**Library (serious)**



**Printer Corner**



# MEETING AND DISCUSSION ROOMS: ALL WITH BLACKBOARD, VIDEO PROJECTORS

- Auditorium = 70 people
- QCD Room ~ 22 (25 max)
- Library ~ 15 + 15 ~ 30



Reservation of video projectors, (slide projectors): See local organisers  
**JPG**, FB, Philippe G, Nicolas B.

Seminar Room allocation: Reserve on the boards outside the auditorium, or on the wiki

# MEETING AND DISCUSSION ROOMS: ALL WITH BLACKBOARD, VIDEO PROJECTORS

- Auditorium = 70 people
- QCD Room ~ 22 (25 max)
- Library ~ 15 + 15 ~ 30



Reservation of video projectors, (slide projectors): See local organisers  
**JPG**, FB, Philippe G, Nicolas B.

Seminar Room allocation: Reserve on the boards outside the auditorium, or on the wiki



# THE WEATHER

In a letter to DeWitt-Morette, Freeman Dyson wrote,

“As I remember it, the school was an overwhelming experience. We were sharing every waking hour with a bunch of ebullient young people ... But **the lectures were the least important part of the school. Much more memorable were the informal sessions, the meals and the walks, the daily hardships of mud and rain we all shared ..** We all lived together in a cowshed and gave lectures in a barn ... living together under primitive conditions is a wonderful way to make friends. **Bad weather makes friendships closer.”**



Les Houches



Search a city

Next days

| WED | THU | FRI | SAT | SUN |
|-----|-----|-----|-----|-----|
| 19  | 20  | 21  | 22  | 23  |
|     |     |     |     |     |
| 28° | 24° | 23° | 21° | 26° |
| 11° | 11° | 10° | 11° | 10° |

Video report



Severe Weather Warning



15 EUROS OFFERTS sur votre commande\* J'en profite



Les Houches



Search a city

Next days

| SUN | MON | TUE | WED | THU |
|-----|-----|-----|-----|-----|
| 23  | 24  | 25  | 26  | 27  |
|     |     |     |     |     |
| 26° | 31° | 34° | 35° | 36° |
| 10° | 12° | 14° | 15° | 16° |

Video report



Severe Weather Warning



15 EUROS OFFERTS sur votre commande\* J'en profite





# Facilities

You will be housed in single rooms with your own bathroom/toilets.

Towels, shampoo, soap, shower gel and hair-dryer are provided.

The school also provides you with:

- a library with the main scientific journals (paper or online) and some reference books
- an open space with many blackboards
- a video projector
- an automated video capture system
- a photocopier machine

# Facilities

You will be housed in single rooms with your own bathroom/toilets.

Towels, shampoo, soap, shower gel and hair-dryer are provided.

The school also provides you with:

- a library with the main scientific journals (paper or online) and some reference books
- an open space with many blackboards
- a video projector
- an automated video capture system
- a photocopy machine
- Internet (wifi + hubs to connect laptops to the local network)
- desktop computers (5 PCs) and a B&W Laser Printer
- 3 washing machines and 3 dryers.
- Three meals a day in our restaurant



# Networks

1. EDUROAM

2. WIFI ACCESS

look at the folder in your pigeon hole, credentials to use this network are given..



- **Restaurant:**

- Lunch: 12.30 **sharp**, coffee (free) after lunch at the bar (below the restaurant)
- Dinner: 19.30. Try and Enjoy the local wines to make new friends. A **jar of wine per table is part of the deal**. More you **pay**.

- **Bar** open after dinner. Count how much you drink, alcohol, beer included, **not free**

- **Coffee and tea breaks:** please wash your cups. **Soda not free (1 euro)**, write your name on the list, settle bill before departure. (Espresso free). No food or drinks in the auditorium/library/..

- **Lunch boxes:** order the night before. If you plan to skip lunch let us know

- Today 19.00 Welcome Drink
  - The Centre Restaurant/Cafeteria
- Monday June 17 Workshop Dinner

# OUTDOOR ACTIVITY

Don't get lost



# OUTDOOR ACTIVITY



## Mountain Bikes

There are 5 mountain bikes, first come, first served. The keys are on a board by the Secretariat. Write your name and indicate the bike number and the time you are reserving for.

The bikes are kept in the shed (building 951) by the restaurant, see intranet=wiki participants

- Climbing, hiking, walks, maps: Jean-Philippe G
  - weather permitting, Sunday is a “rest” day.
- Cycling
- Please inform at least one of the organisers, let them know where you are going, fill **the book in the hall**, give approximate time of when you'll be back
  - It's a good idea to write down your mobile phone number



Follow the guide



# SECRETARIAT IN THE CENTRE

- Secretariat: fees, accommodation issues

Open from 8.45-12.30 & 13.30-17.30 (closed week end)

- Please pay your fees (non FP support)
- FP (those working in the French system): please leave the *attestation* in my pigeon hole
- All non FP will have to contact the Les Houches secretariat and pay the fees directly to them starting from 2pm today
- Ticket (pass) for the Chamonix Valley (buses and train): ask Secretariat

# EMERGENCY NUMBERS




- Fawzi : +33 6 87 82 87 83
- Jean-Philippe: +33 6 52 77 49 50
- Philippe + 33 6 77 78 05 98
- Emanuele +33 7 68 22 86 21
- In case of emergency contact the caretaker, Alpens, Apt 3, +33 6 78 98 52 40. On WE replaced by agents from a security firm, same tel. number

# Session 1

## ▪ **Your seat on the bus**

- Update the list only if you are no longer taking the bus. Deadline for updates is Friday 7 June. List for Session 1 is [here](#)
- For Monday 10th the car driver's telephone number is [to be updated]. The bus company is TransDev.
- If you are registered to take the bus but at the last minute will not be able to take the bus (plane late,..), please call Philippe (Gras) on his mobile at CERN: +41 75 411 1971.


## ▪ **Lodging Plan**

-  [Download the lodging plan for session 1](#). This gives your room and chalet (Name/Chalet/Room Number).
- A map of the Centre will be very handy, especially to locate your chalet. You may save/print  [the leaflet](#) before you come to Les Houches.
- You will also need the **pin code** to enter the buildings/chalets in Les Houches and access your room,  [see here](#). Please make a note of the pin code and save it on your phone address book.

## ▪ **Emergency Numbers**

- Fawzi: +33 6 87 82 87 83 ( on WhatsApp also)
- Jean-Philippe: +33 6 52 77 49 50
- Emanuele: +33 7 68 22 86 21 (Fr) or +41 7 62 78 14 49 (CH)
- Nicolas: +33 6 32 92 43 38
- In case of a serious problem, contact the caretaker, Daniel SECHAUD, Alpens, Apartment 9, 3rd floor, Tel. +33 6 78 98 52 40

## ▪ **Bulletins**

-  [Bulletin No 1. 4 June 2019](#)
- 1st Sunday of Session 1 Bulletin: Programme/Outing for Sunday \*
- 18 June Bulletin : A few important things before you leave \*\*

 [contact the organisers present in session 1](#)

 [Email all the participants of session 1](#) (present in LH)



**In Memoriam**

**Denis Perret-Gallix  
James Stirling**

**Maurice ORLIAC**

HAVE A NICE WORKSHOP!!