# CNRS - node

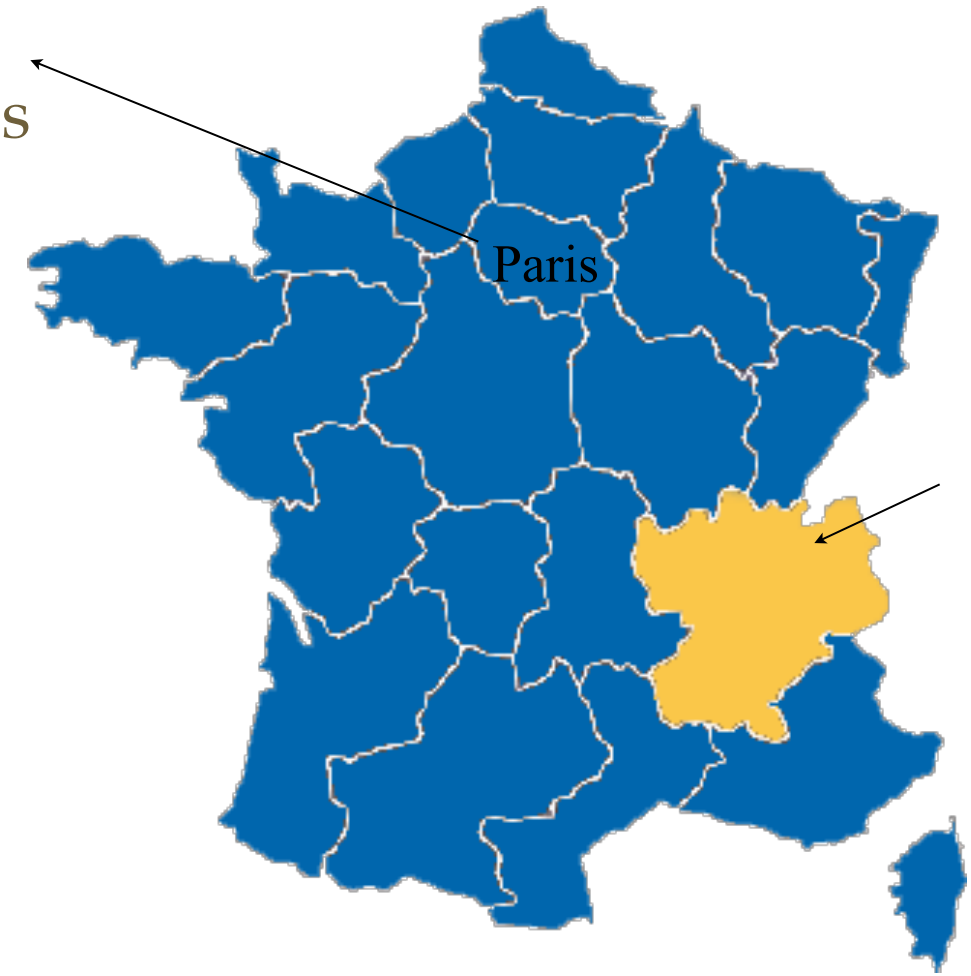
Geneviève Bélanger

HiggsTools kick-off meeting

2-4 April , UCL, London

# CNRS- France

LAL - Orsay
LPT - Orsay
LPTHE - Paris




LAPTh-Annecy
LPSC- Grenoble
IPNL-Lyon

# Members

## LAL- ORSAY

Louis Fayard
Lydia Fayard
Marumi Kado
Reisaburo Tanaka

## LPT-ORSAY

Abdelhak Djouadi
Ulrich Ellwanger
Adam Falkowski
Yann Mambrini

## LPTHE

Matteo Cacciari
Pietro Slavich

ATLAS CMS

Theory

## IPNL - Lyon

Susan Gascon-Shotkins

## LAPTh - Annecy

Genevieve Belanger
Fawzi Boudjema
Jean-Philippe Guillet
Bjorn Herrmann
Eric Pilon

## LPSC - Grenoble

Sabine Kraml

# Topics

- Interpretation of data (WP1)
  - Extraction of model independent results from data in different channels
    - ATLAS : γγ,ττ, bb, ZZ, WW; CMS : γγ (Run 1 and 2)
  - Extending mass range for Higgs searches
  - Double Higgs production
    - ATLAS, CMS : hh, h'h->bbγγ
  - Higgs spin and CP properties
    - ATLAS - LAL, Djouadi, Boudjema
  - Constraints on Higgs couplings from global fits
    - ATLAS - LAL, Belanger, Djouadi, Ellwanger, Kraml

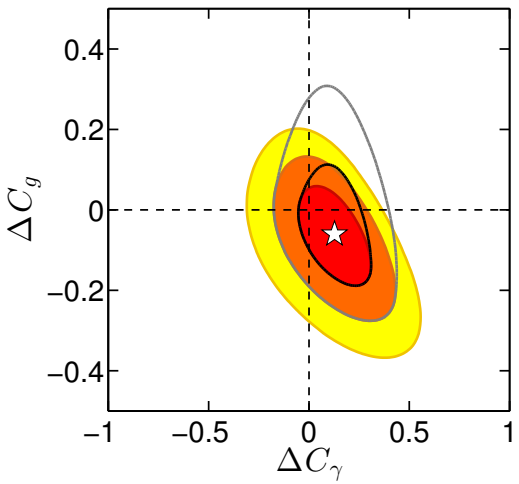
- Interpretation of Higgs data
  - Interpretation within effective Lagrangian
  - Interpretation within specific models
    - LPT, LPSC, LAPTh
  - Interpretation of h->γγ in low mass range within NMSSM, 2HDM .... - CMS+ TH
  - Bounding Higgs width through gg-> γγ, gg->h->γγ interference - CMS

- Future directions

# Higgs Interpretation

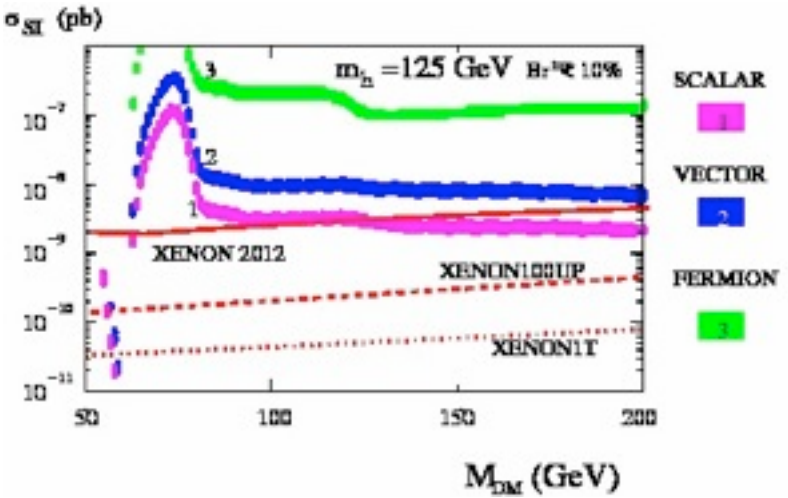
- Effective Lagrangian : systematic expansion of all interactions of H with SM
- with dim6 operators plus some assumptions: -> simplified Higgs Lagrangian

$$\mathcal{L}_{h,\mathrm{sim}} = \frac{h}{v}\Big( \quad 2c_V m_W^2 W_\mu^+ W_\mu^- + c_V m_Z^2 Z_\mu Z_\mu$$
$$- c_u \sum_{q=u,c,t} m_q \bar{q}q - c_d \sum_{q=d,s,b} m_q \bar{q}q - c_l \sum_{l=e,\mu\tau} m_l \bar{l}l$$
$$+ \frac{1}{4} c_{gg} G^a_{\mu\nu} G^a_{\mu\nu} - \frac{1}{4} c_{\gamma\gamma} \gamma_{\mu\nu} \gamma_{\mu\nu}$$
$$- \frac{1}{2} c_{WW} W^+_{\mu\nu} W^-_{\mu\nu} - \frac{1}{4} c_{ZZ} Z_{\mu\nu} Z_{\mu\nu} - \frac{1}{2} c_{Z\gamma} \gamma_{\mu\nu} Z_{\mu\nu} \Big)$$




- Global fits
  - Falkowski, Djouadi, Ellwanger, Belanger, Kraml
  - Public tool for fit to data (Kraml et al)

- Higgs interpretation within extension of SM
  - MSSM, NMSSM, BMSSM, composite, UED, extended scalar (THDM, IDM, Z3M) often motivated or has consequences on DM properties
  - Belanger, Boudjema, Djouadi, Ellwanger, Falkowski, Herrmann, Kraml




Djouadi, Mambrini

- Higgs could be the only link to the dark sector (Higgs portal) or role in DM detection/annihilation
  - Belanger, Djouadi, Mambrini

- Precision calculations (WP2)
  - Precision calculations of non-standard Higgs scenarios M2.2.2
    - Precise predictions for the Higgs mass, production and decay in MSSM and NMSSM (Slavich)
    - MSSM convenor of LHC Higgs cross section WG (Slavich)
    - Higgs sector in non-minimal SUSY extensions,e.g.
      - Split SUSY : improvements in mass spectrum calculation & public code (Djouadi, Slavich)
      - Dirac gauginos : Higgs sector at 2-loop (Slavich)
  - NLO calculations of multiple vector boson production (Boudjema, Guillet, Pilon)
  - Higgs background processes : direct photon
    - CMS

- Improved analysis tools (WP3)- (M3.1.1, M3.1.2)
  - Exploration of better solutions to problems of
    - tagging heavy particles decaying in narrow collimated jets and
    - reducing pileup contamination
  - Integration into fast and reliable analysis tools within FastJet framework (Cacciari)
  - Improvement  for H->bb (ATLAS)

# Other activities

- Workshop Les Houches 'Physics at TeV colliders'
  - Bringing together experimentalists and theorists working on physics at TeV colliders (LHC)
  - odd years
- Workshop series on 'Implications of the 125 GeV Higgs boson'
  - S. Kraml, Grenoble - LPSC
- Link with other nodes
  - ALU-FR, IFJ-PAN