

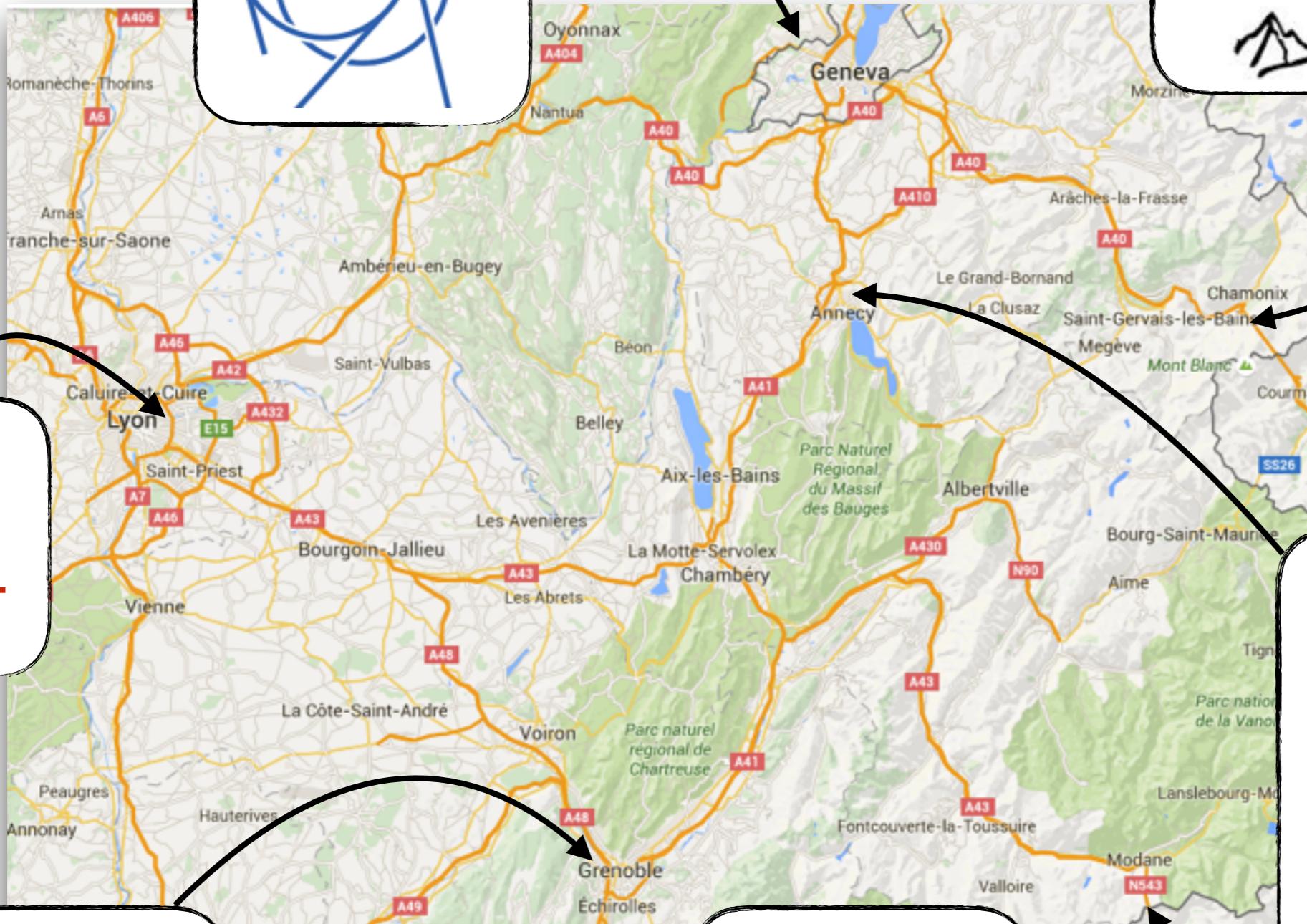
Theoretical particle physics in Annecy and Grenoble



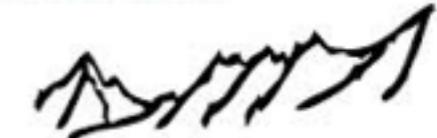
Björn Herrmann
LAPTh, Université Savoie Mont Blanc

Bengaluru, 2-5 may 2016





**ÉCOLE DE PHYSIQUE
des HOUCHES**



IPNL

Lyon

CRAL

Lyon

LPSC

Grenoble



LSM

Modane



LAPTh

Annecy-le-Vieux



LAPP

Annecy-le-Vieux







Laboratoire d'Annecy-le-Vieux de Physique Théorique

Joint research unit
(UMR 5108)



9 full-time researchers
+ 3 emeriti



7 lecturers / professors

Member of the excellence cluster “Enigmass”





Laboratoire d'Annecy-le-Vieux de Physique Théorique

In may 2016...

- 16 research staff** (10 researchers + 7 faculty)
- 3 emeriti**
- 1 research staff member on secondment abroad**
- 6 postdocs** (CNRS, ANR, Enigmass)
- 7 PhD students** (Univ. Grenoble Alpes)
- 8 Master students** (Grenoble, Lyon, Montpellier, Paris, Lebanon)
- 2 visitors**
- 3 administration staff**
- 2 IT support staff**

... about 40 people at any given time!



Laboratoire d'Annecy-le-Vieux de Physique Théorique

Three research teams

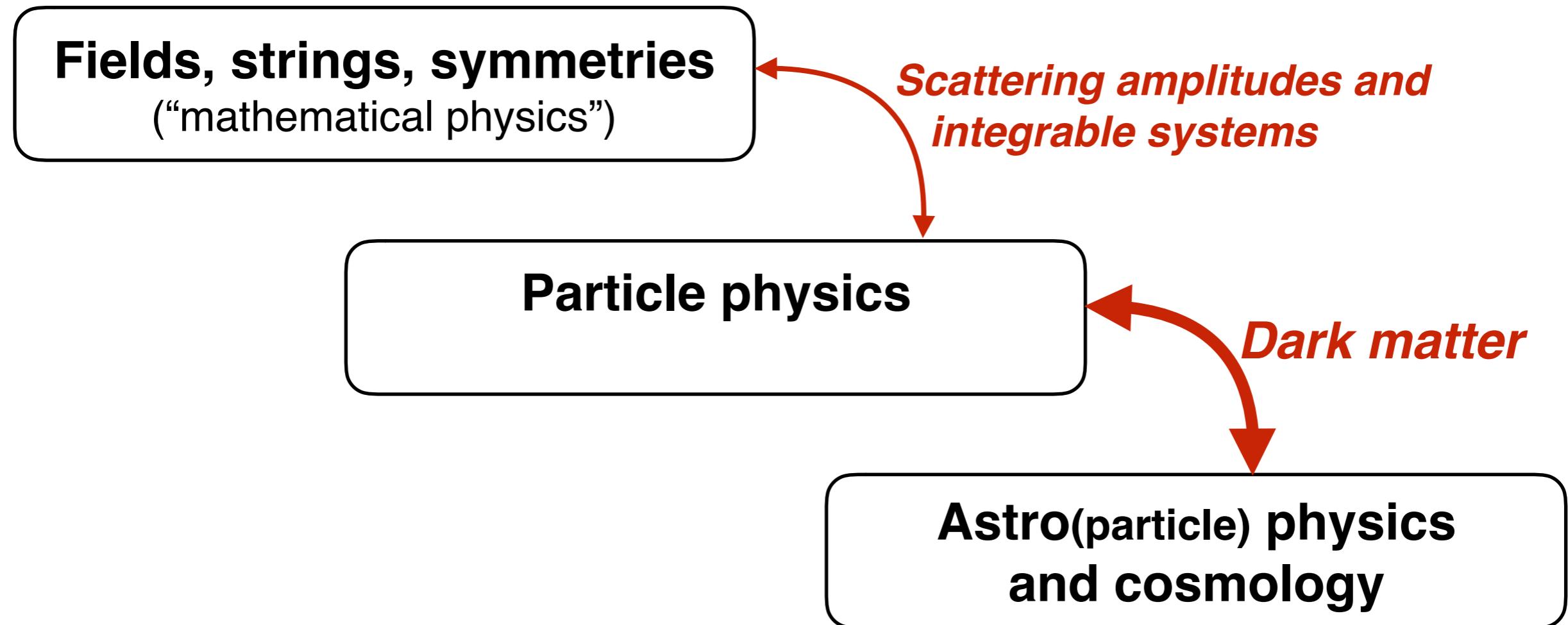
Fields, strings, symmetries
("mathematical physics")

Particle physics

**Astro(particle) physics
and cosmology**

Laboratoire d'Annecy-le-Vieux de Physique Théorique

Three research teams



Scattering amplitudes in gauge and string theories

- N=4 Super Yang Mills
- Conformal and superconformal symmetries
- Wilson loops
- Exact solutions and integrability
- Application to QCD, recursion relations

Integrable systems

- Algebraic approach to spin chains
- Bethe Ansatz
- Integrability in gauge theories
- Application to condensed matter and statistical physics

Field theory and topology

- Chern-Simons theories
- Geometric quantisation

Dark matter

- indirect signatures
- formation of proto-haloes
- alternative WIMPs

Cosmic rays

- sources of galactic cosmic rays
- propagation of galactic cosmic rays
- gamma rays and radio skies
- anisotropies

Particle astrophysics and stars

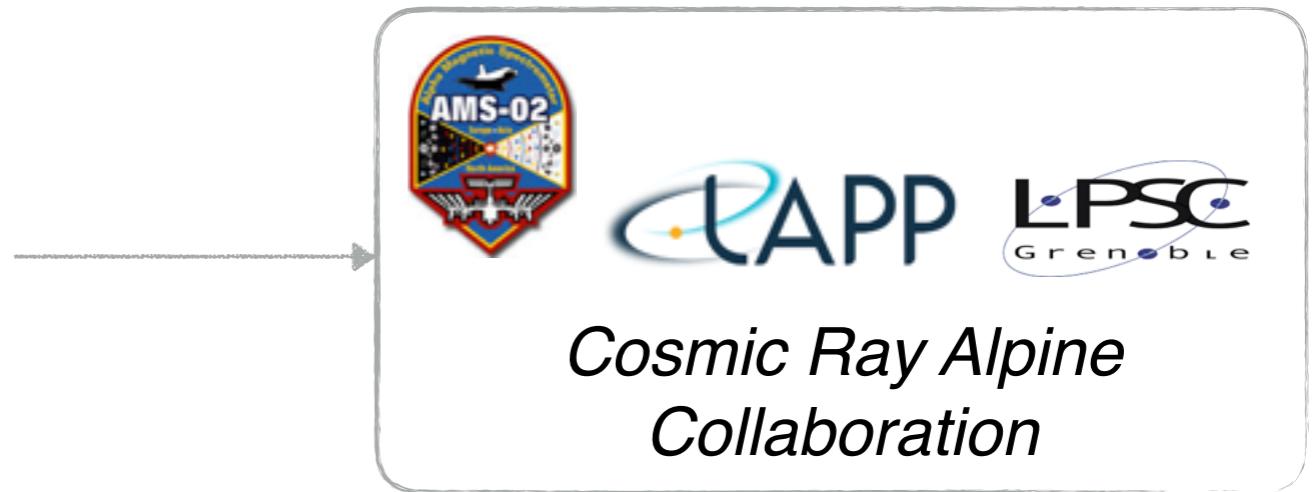
- low-energy neutrinos
- gamma-ray bursts

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Particle astrophysics and stars

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Particle physics – General presentation



Geneviève Bélanger



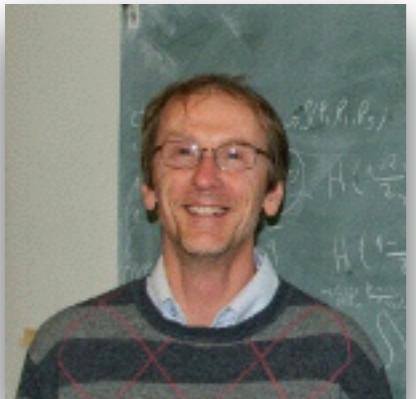
Fawzi Boudjema



Diego Guadagnoli



Shanka Banerjee



Jean-Philippe Guillet



Björn Herrmann



Daniele Barducci



Eric Pilon



Emanuele Re



Bryan Zaldivar



Cédric Delaunay

Quantum chromodynamics

- inclusive processes at large energy/momentum transfer

Precision calculations

- next-to-leading order calculations
- renormalization
- new calculation techniques

Quantum chromodynamics

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PHOX family

DIPHOX, JETPHOX, EPHOX, TWINPHOX

$h_1 h_2 \rightarrow \gamma\gamma X$, $h_1 h_2 \rightarrow h_3 \gamma X$, $h_1 h_2 \rightarrow h_3$,
 $h_1 h_2 \rightarrow h_3 h_4$, $h_1 h_2 \rightarrow \gamma j$, $h_1 h_2 \rightarrow \gamma$, $h_1 h_2 \rightarrow h_3 j$,
 $h_1 h_2 \rightarrow jj$,
 $\gamma h_1 \rightarrow \gamma j$, $\gamma h_1 \rightarrow \gamma$, $\gamma h_1 \rightarrow h_2 j$, $\gamma h_1 \rightarrow jj$,
 $\gamma\gamma \rightarrow \gamma j X$, $\gamma\gamma \rightarrow \gamma X$, $\gamma\gamma \rightarrow jj X$



http://lapth.cnrs.fr/PHOX_FAMILY

Quantum chromodynamics

- inclusive processes at large energy/momentum transfer

Precision calculations

- next-to-leading order calculations
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POWHEG BOX

implementing NLO calculations in shower Monte Carlo programs according to the *POWHEG* method

production and decay of vector-bosons, Higgs bosons, tops, jets,...

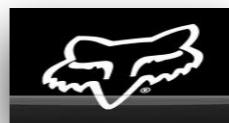
<http://powhegbox.mib.infn.it>



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Collider phenomenology

- new physics models: Supersymmetry, inert doublet model, vector-like fermions...
- interplay with astroparticle and flavour physics

Dark matter candidates

- relic density calculation
- direct and indirect detection
- production and signatures at colliders

Flavour physics

- heavy flavour theory and CP-violation
- non-minimal flavour violation in supersymmetric theories
- minimal models for neutrino masses and dark matter

Higgs physics

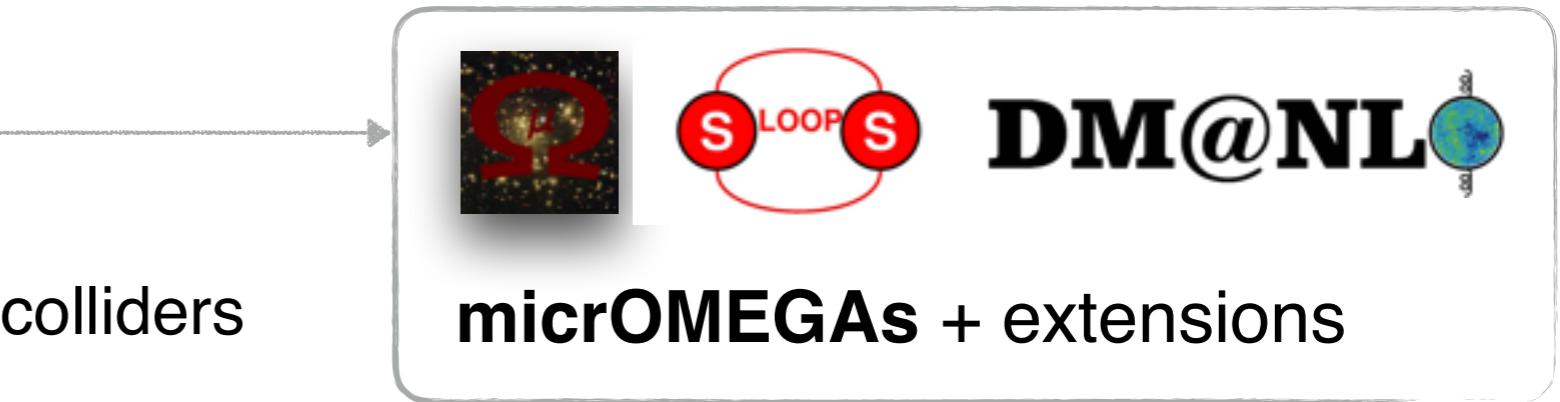
- precision calculations
- new approaches to Higgs precision measurements

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International collaborations



International collaborations



LIA – France-Russia, France-India,

Vietnam, Japan, Korea

Exchange program – China

GDRI – France-Marocco

MoU – CERN, DESY, Boston, KITP,
IISc Bangalore, Münster, Torino...

International collaborations



Training – (pre)doctoral schools
Algeria (Jijel, Oran), Vietnam, Lebanon,
Erasmus EU-Turkey, Russia...
GRASPA (LAPP/LAPTh, Enigmass)



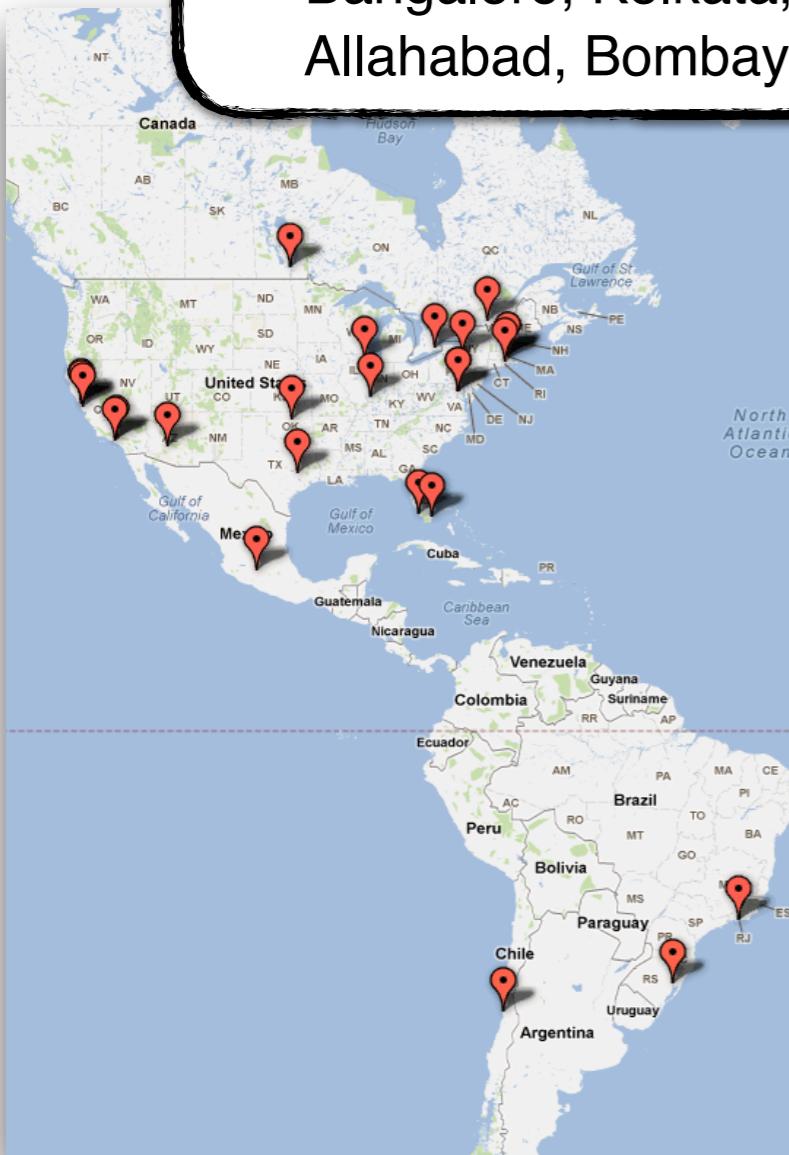
LIA – France-Russia, France-India,
Vietnam, Japan, Korea
Exchange program – China
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International collaborations



Indo-French collaborations

- Bangalore, Kolkata, Allahabad, Bombay



LIA – France-Russia, France-India,

Vietnam, Japan, Korea

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Workshop: Physics at TeV Colliders ("PhysTeV @ LesHouches")

- phenomenology at TeV colliders
- theorists and experimentalists
- 2 sessions (SM vs. BSM) organized in three working groups each
- special "Les Houches - style" format

Save the date: 5 – 23 June 2017

 <http://phystev.cnrs.fr>





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Other workshops

- Tools for New Physics
- RAQIS (Recent Advances in Quantum Integrable Systems)



Laboratoire de Physique Subatomique et Cosmologie

Joint research unit
(UMR 5821)



in total 37 full-time researchers and 28 faculty — 4 theorists

Member of the excellence cluster “Enigmass”



Particle physics – Theory group



Sabine Kraml



Mariane Mangin-Brinet



Guillaume Chalons



Kentarou Mawatari



Ingo Schienbein



Christopher Smith



Dipan Sengupta

**Precision calculations, Physics beyond standard model,
Monte Carlo generators, Nuclear PDFs, Lattice QCD...**

