



COURSE ON

# PHYSICS AT THE LHC

MARCH - JUNE 2018, LISBON - PORTUGAL

[idpasc.lip.pt/LIP/events/2018\\_lhc\\_physics](http://idpasc.lip.pt/LIP/events/2018_lhc_physics)

## PROGRAM

6, 7 March	The standard model of particle physics	João Varela
14, 15 March	Detector physics and experimental methods	Michele Gallinaro, Pedro Silva
19 March	Statistical methods in data analysis	Pietro Vischia
22, 23, 26 March	Top quark physics	Michele Gallinaro, António Onofre
2, 4, 9, 11 March	Standard model Higgs and beyond	Ricardo Gonçalo, Patricia Muiño, Pedro Silva, Michele Gallinaro
16, 18 March	Supersymmetry	Pedrame Bargassa
2 May	Exotic processes and Dark Matter	Michele Gallinaro
7 May	Heavy flavor physics and rare decays searches	Nuno Leonardo
9 May	Matter at high density and temperature	João Seixas

Course coordinators: J. Varela, M. Gallinaro

The lectures will take place between at LIP,  
Av. Prof. Gama Pinto, Complexo Interdisciplinar (3Is), n.2  
1649-003 Lisbon - Portugal



# Introduction

- Specialized course on the Physics at the Large Hadron Collider organized by LIP in the framework of IDPASC
- The goal of the Course is to introduce the physics, analysis methods, and results of the LHC experiments
- Emphasis is placed on the search for new physics
- Benchmark channels in proton-proton collisions will be discussed:
  - identification of the objects involved
  - signal and background properties
  - background estimation and S/B discriminants
  - estimation of systematical errors
  - extraction and interpretation of the final results

# Introduction (cont.)

- Course intended for under-graduate or graduate students with basic training in Particle Physics
- *Basic concepts*
- Elementary constituents of matter and interactions. Quantum numbers and conservation rules. Spin and symmetry groups. Relativistic kinematics. Cross-section. Natural units. Mass and lifetime. Resonances.
- *Structure of matter*
- Elastic scattering and form factors. Inelastic scattering experiments. Nucleon structure functions. Scale invariance. Quark model. Parton distribution functions. Introduction to QCD.
- *Fundamental interactions*
- Introduction to QED. Fermi interaction. Parity violation. Currents V-A and weak doublets. W and Z bosons. Cabibbo angle. Neutral currents. Electroweak interaction. Gauge symmetries. The Higgs mechanism. Weinberg-Salam model. CP violation.

# bibliography

- F. Halzen and A.D.Martin, ' Quarks and Leptons ', John Wiley and Sons (1984)
- D. Griffiths, ' Introduction to Elementary Particles ', John Wiley and Sons (1987)
- B.R.Martin, G. Shaw, ' Particle Physics ', John Wiley and Sons (1999)

# Course certification

- Will provide *Certificate of Attendance* to those who attend at least 80% of the lectures
- Recognized as a course at IST (with *credit*) for those:
  - Who will attend at least 80% of the lectures
  - Who will pass a final exam (give a short seminar and Q&A session)
  - Registered under “*Topicos em Fisica de Particulas*”