Testing the Standard Model of Elementary Particle Physics I

Introduction

Dr. Dominik Duda

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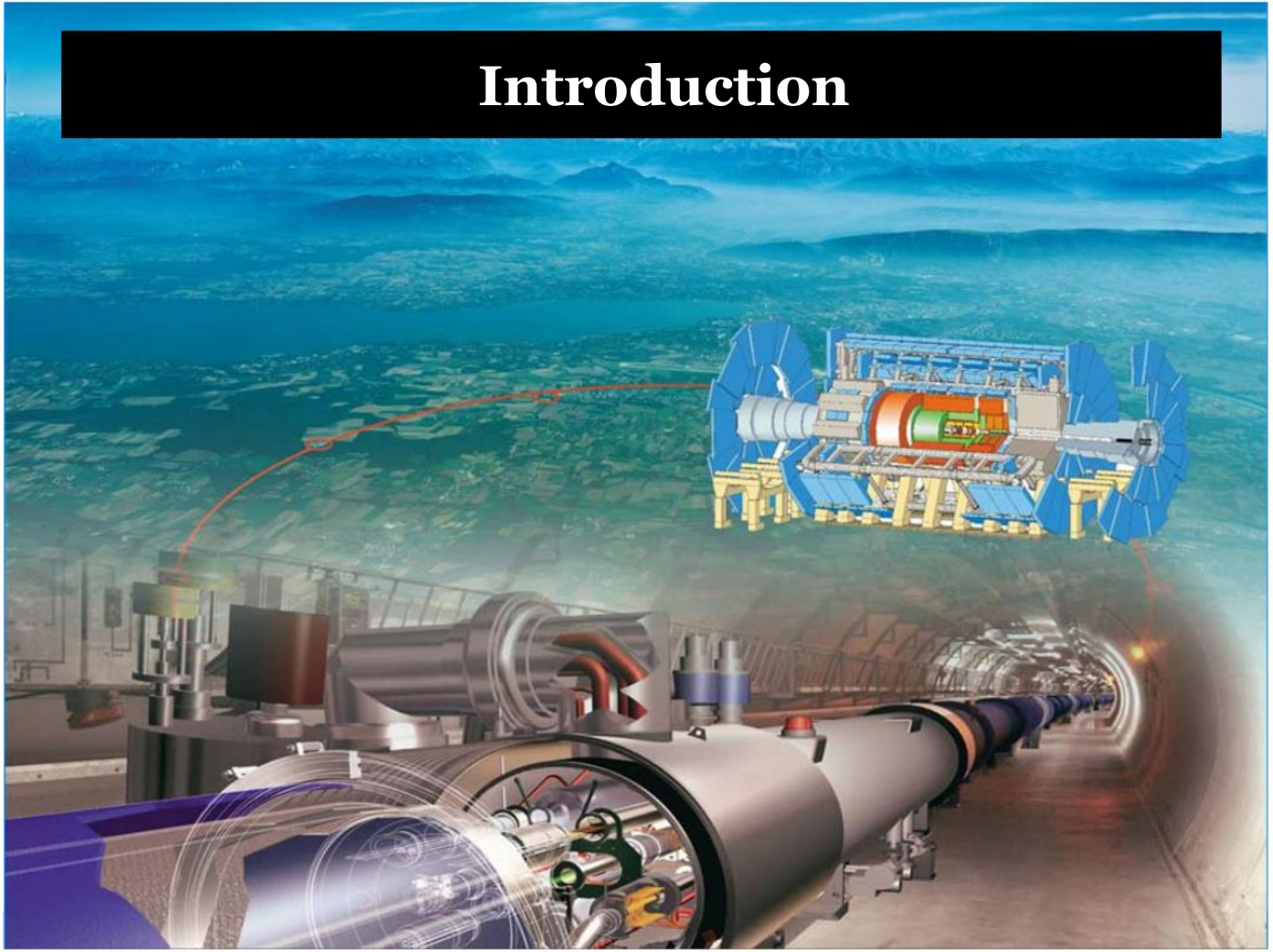
Introduction



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Housekeeping

- **Basic information (Module PH2045):**
  - Contact hours: 30 h
  - Credits (ECTS): 5 CP
  - Offer tutorials (optional) for deepening and widening of the acquired knowledge.
- **Module Exam:**
  - Oral examination of 30 minutes duration at the end of the semester (discussing comprehension questions, sketches and simple formulae that have been previously presented in this course)
    - Or 60 minutes duration for an exam of Testing the SM I & II
- **Material to the lectures (and tutorials) will be made available to everyone**
  - **Will announce the location via email**

Curriculum

4. Recent experimental Tests on the Standard Model of Particle Physics

- 4.1 Precision Measurements of the Electroweak Interaction
- 4.2 An overview of the physics program at the Large Hadron Collider
  - 4.2.1 Basics of Monte Carlo generations
  - 4.2.2 Statistics for Pedestrians
  - 4.2.3 Measurements and Searches
- 4.3 The Higgs Boson (Searches and Measurements)
  - 4.3.1 Searches at LEP, Tevatron and the LHC
  - 4.3.2 Measurements of Higgs boson properties
- 4.4 The Top quark
- 4.5 B-Hadron Decays and CP Violation
- 4.6 Neutrino Masses and Oscillation

Curriculum

5. Extension of the Standard Model of Particle Physics

- 5.1 Open Questions
- 5.2 Great Unification
- 5.3 Supersymmetry
- 5.4 Dark Matter
- 5.5 Extended Higgs sector
- 5.6 “Exotic” Beyond the Standard Model theories
- 5.7 Ongoing Searches for Beyond the Standard Model Physics

6. Machine Learning in High Energy Physics

Tutorials

- Optional but encouraged !!!
- Will be lead by **Michael** and **Margherita** who will take turns.
- Will follow the lecture, but we are happy to adjust our planning if you want to learn (more) about a particular topic.
  - **Please speak up !**
  - **Will follow a more or less irregular schedule (biweekly for most of the time)**
- Please fill out the doodle poll (such that we can find a good time):
  - Follow this Link: https://doodle.com/poll/gfdtiy7h6azrye7p?utm_source=poll&utm_medium=link

Literature

- B. Povh, K.Rith, Ch. Scholz, F. Zetsche: **Teilchen und Kerne**, Springer, 4th edition, 1997.
- Ch. Berger: **Elementarteilchenphysik**, Springer, 2002.
- P. Schmüser: **Feynmangraphen und Eichtheorien für Experimentalphysiker**, Springer, 2nd edition, 1995.
- I.J.R. Aitchison, A.J.G. Hey: **Gauge Theories in Particle Physics**, Vol. 1, Institute of Physics Publishing, new edition, 2002.
- W. Greiner, B. Müller: **Quantum Mechanics–Symmetries**, Springer, 2nd edition, 1994.
- Ian Brock, Thomas Schörner-Sadenius: **Physics at the Terascale**, WILEY-VCH, 2011
- D. Griffiths, **Introduction to Elementary Particles,** WILEY-VCH**,** 2008, 2nd edition
- Amitabha Lahiri, Palash B. Pal: **A first book of QUANTUM FIELD THEORY**, Alpha Science, 2nd edition, 2007