

# Particle Physics 1 - Fall 2017

This is a first year course for all master students in the (experimental) particle physics programme of the UU, UVA, VUA and UT. Other students (theory etc.) are welcome too.

## 1 Place and Time

The course consists of 14 lectures. These take place each Monday and Wednesday morning in room **H331 at Nikhef**, Sciencepark 105, Amsterdam.

The first lecture will be on **Monday September 4th** and starts at **9.00 am**. The other lectures start at **9.30 am** and end at **13.00**. The last  $\sim 1.5$  hours of each lecture are reserved for tutorials. The last lecture will be on Monday October 16th.

To enter the Nikhef building one normally needs an electronic key. If you do not have a key, please ask for admission to the building at the reception stating that you will attend the PP1 lecture in room **H331**.

Course information can also be found on  
[http://datanose.nl/#course\[61031\]](http://datanose.nl/#course[61031])  
and on this website:  
<http://www.nikhef.nl/~i93/Teaching>

## 2 Teachers

Lecturers:

- Marcel Merk, room N243, [marcel.merk@nikhef.nl](mailto:marcel.merk@nikhef.nl)
- Ivo van Vulpen, room H241, [ivo.van.vulpen@nikhef.nl](mailto:ivo.van.vulpen@nikhef.nl)
- Wouter Hulsbergen, room N255, [wouterh@nikhef.nl](mailto:wouterh@nikhef.nl)

Assistents:

- Laurent Dufour, room N254 [laurent.dufour@nikhef.nl](mailto:laurent.dufour@nikhef.nl)
- Maarten van Veghel, room N252 [mvegh@nmikhef.nl](mailto:mvegh@nmikhef.nl)

Do not hesitate to contact lecturers or assistents inbetween lectures.

## 3 Lecture notes and books

Course **lecture notes** will be available. The lecture notes contain exercises, one set for each of the 14 lectures. The exercises will be discussed in the tutorial sessions.

It is strongly recommended that you get hold of a good text book to supplement the lecture notes. The recommended book is *Modern particle Physics* by Mark Thomson.

However, there are many other good text books. These lectures were originally based on Halzen & Martin: *Quarks & Leptons: An Introductory Course in Modern Particle Physics*. This book is a bit outdated (1984), still very good, but no longer in print. Besides the book by Thomson, a decent alternative is the second edition of Griffiths, *Introduction to Elementary Particles* (2008). Most people agree that Griffiths is more pleasant to read than Halzen & Martin, but that it is also a bit less formal. We also like Aitchison and Hey's *Gauge theories in particle physics, Volume 1*, but this is considerably more formal. In particular, it discusses field theory, which is not part of this course.

A few text books will be on display the first lecture, so you could decide to wait till after the first lecture before purchasing a book.

## 4 Contents

The course contains the following topics:

- relativistic wave equations
- scattering perturbation theory
- electromagnetic scattering of spinless particles
- the Dirac equation
- electromagnetic scattering of spin 1/2 particles
- the weak force
- local gauge invariance
- massless electroweak standard model
- the Higgs mechanism

It is assumed that you have prior knowledge of

- relativistic kinematics
- electrodynamics (Maxwell equations)
- quantum mechanics (Schrödinger equation, angular momentum)

Students that have followed a bachelor course in particle physics certainly have an advantage. Others should at least read the introductory chapter of one of the text books above.

## 5 Examination

The exam takes place at 9h00 on Wednesday October 25th, location: James Watt straat (JWS), room 2. It is an open book exam: You may bring the lecture notes and a text-book of your choice, but no laptop.