# Standard Model and Flavour PhD Course

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## Overview

The lectures will be divided in three parts. In the first part of the course we will review precision electroweak measurements at the energy frontier upon which the global electroweak fit is based. In the second part we will introduce the CKM matrix and the unitarity triangle and discuss the measurement of its angles and sides. We will then present the B meson rare decays as a tool to search for new physics at the intensity frontier. Finally we will discuss the searches of dark matter at colliders. In the third part we will cover some advanced topics such as the amplitude analysis and the search for exotic states.

## Prerequisites

Sub-nuclear physics course, basic principles of theoretical physics.

## Learning outcomes

### Part1: 10 hours (A. Zucchetta o M. Tosi)

- Measurement at the Z pole (LEP 1 and SLD): Z mass and width, eff, braching fractions
- Asymmetries: forward-backward, left-right, polarization
- W mass (and width) at Lep II and Tevatron
- top mass (Tevatron and LHC): methods and issues
- Higgs discovery and measurements: mass, width, spin, coupling

- Global ElectroWeak fit.

### Part2: 12 hours (G. Simi)

- The Motivation for studying the CKM Matrix, the CKM mechanism and what is CP violation
- B meson oscillations as a tool to observe CP violation
- Techniques to measure B and D mesons mixing
- How to measure CKM Angles measurements ($\alpha$, $\beta$, $\gamma$),
- How to measure CKM Sides Vub and Vcb
- B decays as constraints on new physics
- How to search for dark matter at colliders

### Part 3: 8 hours (A. Palano)

- Experimental techniques to perform amplitude analysis of resonant decays
- how to search for exotic (multiquark) states

## Assessment

The exam will consist in a presentation on an experimental topic among those covered or suggested during the course. Note: **The course will take place with a minimum of 3 partecipants**.

## Period

4 weeks in the perdiod from May to July, with precise schedule to be decided together with the students.