

Carleton University Department of Physics
PHYS 6601 – Particle Physics Phenomenology (Fall 2013)
Course Outline

Instructors:

Bruce Campbell (campbell@physics.carleton.ca, 613-520-2600 x4322, 3378 HP)

Heather Logan (*coordinator*) (logan@physics.carleton.ca, 613-520-2600 x4319, 2450 HP)

Alain Bellerive (alainb@physics.carleton.ca, 613-520-2600 x7537, 3316 HP)

Manuella Vincter (vincter@physics.carleton.ca, 613-520-2600 x1567, 2458 HP)

Lecture times: Mondays and Wednesdays, 2:30–4:00 p.m., 308 Southam Hall.

Course Description

This course covers much of the required knowledge for research in particle physics from both the experimental and theoretical points of view. Topics include: standard model, parton model, quark model, hadron spectroscopy, and experimental tests.

B. Campbell: Quarks and QCD [Sept 9, 11, 16, 18, 23 and 25]

These lectures will cover parton model calculations of hard scattering processes at colliders, and how QCD corrections can be systematically implemented in these calculations. They will show relevant data supporting the QCD-improved parton model, and specifically try to explain the QCD-improved parton model calculations underlying LHC analyses that many of our graduate students will be undertaking.

H. Logan: Electroweak Interactions and the Higgs [Sept 30, Oct 2, 7, 9, 16 and 21]

These lectures will cover the electroweak sector of the Standard Model from the ground up: the gauge interactions, Higgs mechanism, and fermion masses and mixing. They will also cover Higgs physics and precision tests of the standard electroweak model.

A. Bellerive: Flavour Physics and CP Violation [Oct 23, Nov 4, 6, 11, 13, and 18]

These lectures will cover the flavour sector of the Standard Model: sequential decays, Heavy Quark Symmetries (HQS), CKM matrix, quark mixing, leptonic decays, semileptonic decay, unitarity triangle, CP Violation, kaon/charm/beauty sectors and experimental overview. They will also cover neutrino oscillations and CP violation.

M. Vincter: The Experimental Basis for the Standard Model [Nov 20, 25, 27, Dec 2, 4 and 9]

Topics covered will include experimental evidence for the particle constituents of the Standard Model, precision electroweak tests from electron-positron colliders, and results from the Large Hadron Collider.

Assignments and Grade Distribution

Homework assignments (4 × 20%):

Each of the four instructors will assign a set of homework problems. The deadline for handing in assignments is two weeks after they have been given out.

Final seminar (20%):

Each student will be expected to give a 20-minute seminar on a topic in particle physics. Please discuss your choice of topic with the course coordinator (H. Logan) no later than mid-October. You should take this opportunity to learn about a particle physics topic that is not directly related to your thesis research. The talks will be scheduled at the end of term in consultation with the class.

Academic Policies

Please read and be familiar with the following Carleton University policies:

Privacy and freedom of information: <http://www6.carleton.ca/privacy/> .

Academic integrity: see item 18 of <http://calendar.carleton.ca/grad/gradregulations/> , in particular the sections on plagiarism and the unauthorized resubmission of work.

Academic Accommodation Policies

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation: write to me (H. Logan) with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: <http://www2.carleton.ca/equity/> .

Religious obligation: write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details visit the Equity Services website: <http://www2.carleton.ca/equity/> .

Academic accommodations for students with disabilities: The *Paul Menton Centre* for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your *Letter of Accommodation* at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (*if applicable*). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally-scheduled exam (*if applicable*) at <http://www2.carleton.ca/pmc/new-and-current-students/dates-and-deadlines> .

You can visit the Equity Services website to view the policies and obtain more detailed information on academic accommodation at <http://www2.carleton.ca/equity/> .