

# Y3 Particle Physics

2011-12

Dr. N.K.Watson

"Office Hours"

Monday and Thursdays, in the hour following lectures

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Course Material

Updated lecture by lecture on

<https://www.ep.ph.bham.ac.uk/twiki/bin/view/General/Y3Pp>

WebCT for course has two links: one to above, and one to previous course material

# Outline

- Relativistic Kinematics
  - ▶  $(4\text{-momentum})^2$  invariance, invariant mass
  - ▶ Hypothesis testing, production thresholds
  - ▶ Cross sections, flux and luminosity
  - ▶ Particle lifetime, decay length, width
- Classification of particles
  - ▶ Fermions and bosons
  - ▶ Leptons, hadrons, quarks
  - ▶ Mesons, baryons
- Quark Model
  - ▶ Meson and baryon multiplets
  - ▶ Isospin, strangeness, c, b, t quarks
- Particle Interactions
  - ▶ Virtual particles and range of forces
  - ▶ Strong and weak decays, conservation rules
  - ▶ Parity, charge conjugation, CP
  - ▶ Weak decays of quarks
  - ▶ Colour charge, QCD, gluons
  - ▶ Charmonium and epsilon systems
- Electroweak Interactions
  - ▶ Charged and neutral currents
  - ▶ W, Z, LEP experiments
  - ▶ Higgs and the future
- LHC Experiments
- Future - introduction to accelerator physics

# Fast moving!

22 Dec. 2011 Chi\_b(3P) - 1st observation

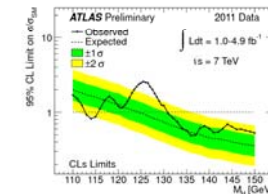
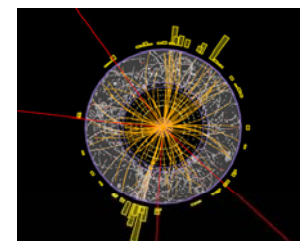
The screenshot shows a BBC News article from December 22, 2011. The headline is "LHC reports discovery of its first new particle". The article mentions that the Large Hadron Collider (LHC) has discovered a new particle, which is a  $\chi_{b(3P)}$ . It also notes that this discovery is significant as it is the first new particle discovered since the LHC started operating in 2009.

Andy Chisholm, a PhD student from Birmingham who worked on the analysis, said: "Analysing the billions of particle collisions at the LHC is fascinating. There are potentially all kinds of interesting things buried in the data, and we were lucky to look in the right place at the right time."

15 months after starting his PhD in Birmingham - only 3 years ahead of y3

# Fast moving!

Status reports from ATLAS and CMS, 13 Dec. 2011  
ATLAS interesting event and summary



"We have restricted the most likely mass region for the Higgs boson to 115-130 GeV, and over the last few weeks we have started to see an intriguing excess of events in the mass range around 125 GeV," explained ATLAS experiment spokesperson Fabiola Gianotti. "This excess may be due to a fluctuation, but it could also be something more interesting. We cannot conclude anything at this stage. We need more study and more data. Given the outstanding performance of the LHC this year, we will not need to wait long for enough data and can look forward to resolving this puzzle in 2012."

## CERN Summer Studentships

Deadline for applications: 25 January 2012



2011 summer students

- Between 8 and 13 weeks working at CERN
- A living allowance to cover the expenses of a single person in the Geneva area.
- Travel allowance (on a lump sum basis).
- The CERN Housing Service will assist you in finding accommodation on, or near the site of the laboratory.
- 11 June - 28 Sept

[https://ert.cern.ch/browse\\_www/wd\\_portal.show\\_job?p\\_web\\_site\\_id=1&p\\_web\\_page\\_id=9868](https://ert.cern.ch/browse_www/wd_portal.show_job?p_web_site_id=1&p_web_page_id=9868)

## DESY Summer Studentships

Deadline for applications: 31 2012

### SUMMER STUDENTS

DESY Summer Student Programme 2012

- July 17 to September 6
- Subsistence for single person
- Travel (up to €130)

<http://summerstudents.desy.de/>