

Week 4 – February 15/17, 2022

LHC and Hadron Collider Physics

Objectives

- Review history of particle accelerators
- Identify design and choice of magnets in accelerators and detectors
- Understand current state of upgrades in CERN's long-term plan
- Identify limitations of lepton vs hadron colliders, linear vs circular

HW due Today:

- Arrange paper assignment via email (see feedback from last week)
- Describe, in as much detail as you can, the path of a proton: from hydrogen gas bottle to collision. Send via email.

HW due Tuesday Feb 22nd:

- Prepare 5-min presentation of your paper, send slides/outline/notes ahead of time via email
- Set of questions on last slide

Class Outline

- What's a particle?
 - Classical vs QM vs QFT
 - Rutherford's gamma rays, plus the alphas and the betas
- Overview of particle accelerators
 - LINAC
 - Cyclotron -> Synchrotron
 - LHC Complex
- Magnets of the LHC
 - Bending
 - Focusing
- Long-term plans at CERN
- Protons
 - Structure at different energy scales
 - Hadron collisions
 - Parton Distribution Function
 - Intro to Underlying Event, Pileup, Hadronization