FYSC14 compulsory elements

Wednesday 26/3 (introduction)

Thursday 17/4 (lab-prep)

Lab period 2 (Separate 2.5 hp grade)

Two written assignments to be handed in (25% of final 5 hp grade)

Oral exam (75% of final 5 hp grade)

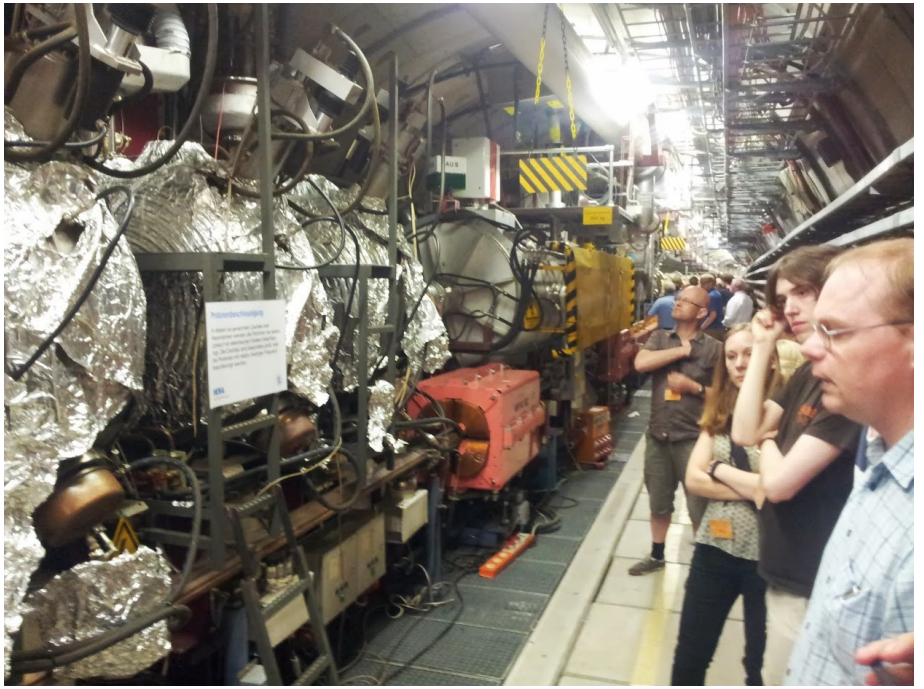
All partial elements of the course: written assignment 1+2, lab, oral exam, DESY trip have to be passed for the course to be passed.

A final Swedish Grade – U, G, VG – (and a percentage/ECTS grade) will be provided.

DESY visit 5-7/6

- Compulsory element!
  - Dates: Thursday 5th of June to Saturday 7th of June
  - Friday 6th of June we visit DESY (Deutsches Elektronen-Synchrotron) in Hamburg Germany
  - Deposit of 200 SEK needs to be paid to Mikael Antic. Will get money back in Hamburg!
  - University pays for transport and hostel

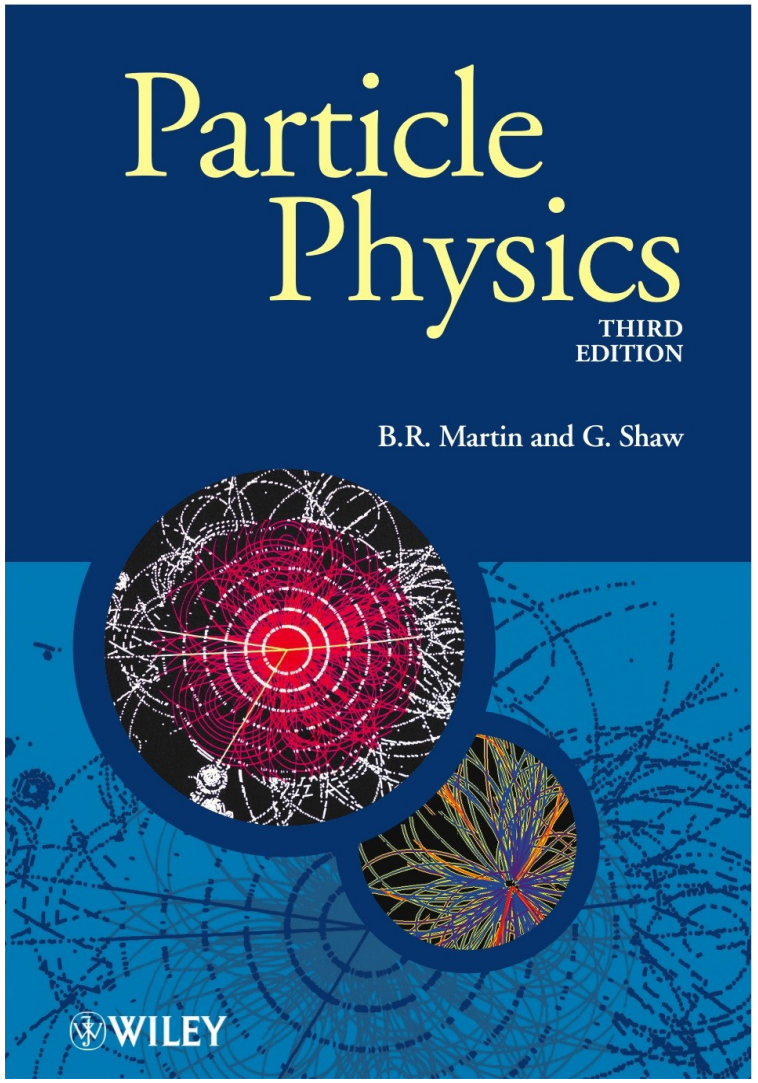
DESY trip pictures



Material

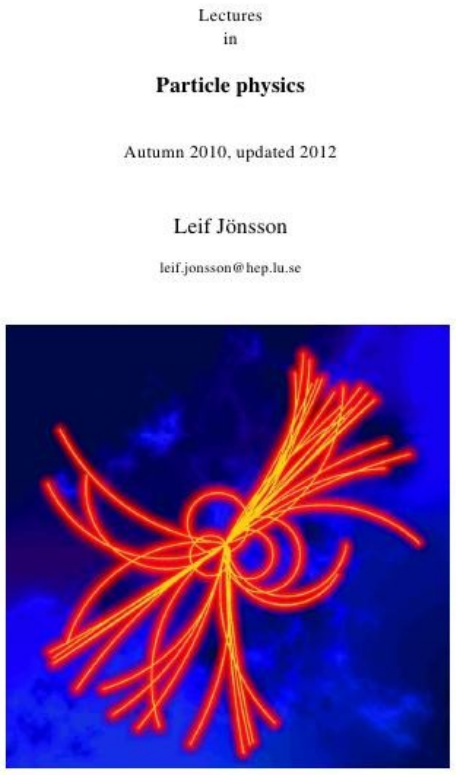
- Please consult also:
  http://www.utbildning.fysik.lu.se/tibet/template/personal%2CIndex.vm?pageid=241426&siteid=1000

Lecture materials (1/3)
DEFAULT



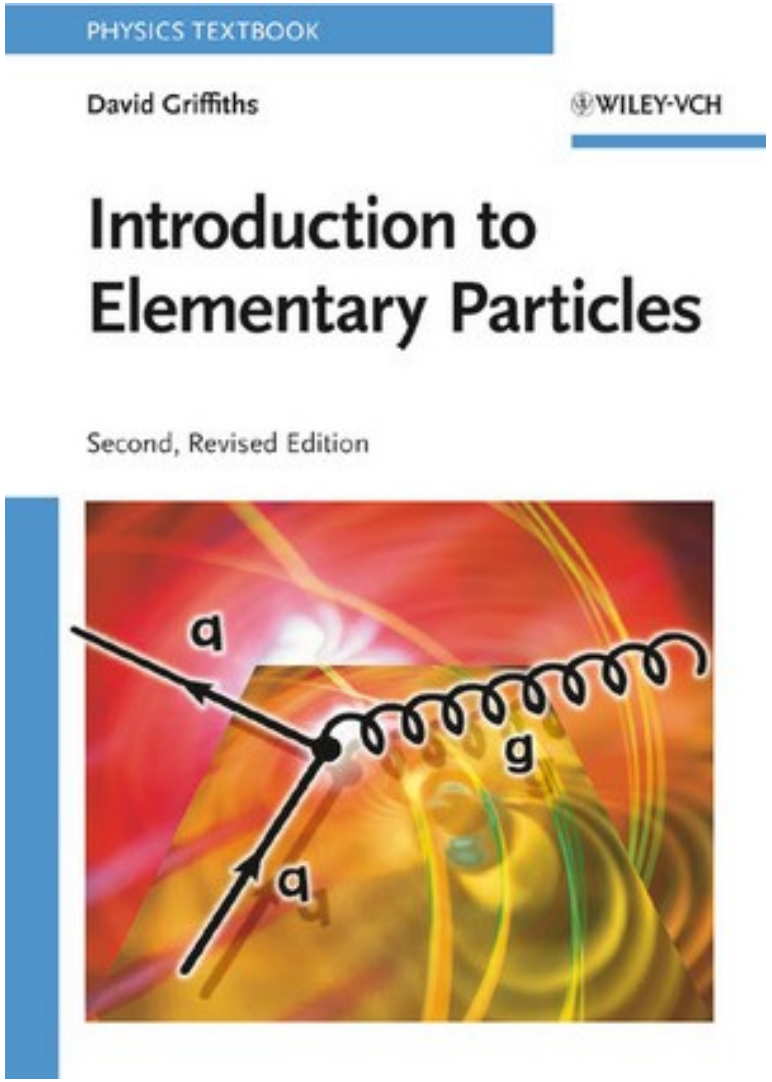
- This is the official book and this is the one we will follow!

Lecture material (2/3)
Condensed, extensive and free!



- Leif's notes. Leif was the original lecturer on this course and for many years.
- Chapter 1 is still part of the official colloquium for the course.
  - This time the notes will also be used in the introduction of Feynman diagrams and rules
- Short concise text with a lot of material

Lecture material (3/3)
More focus on theory



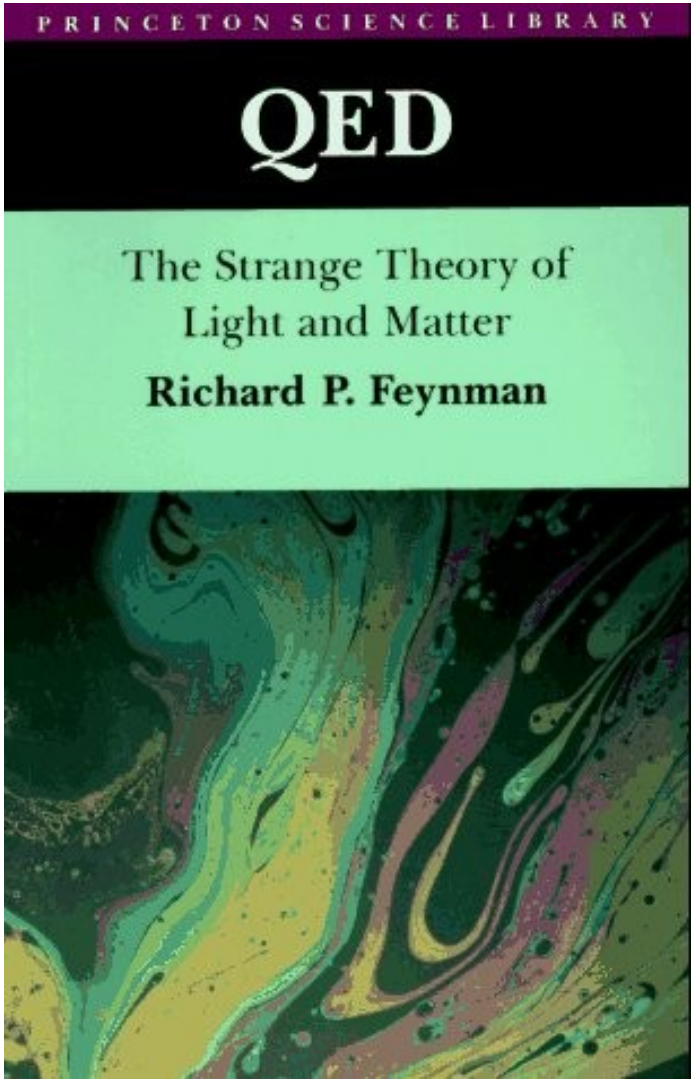
- Griffiths can give you a much better mathematical understanding of the Feynman diagrams.

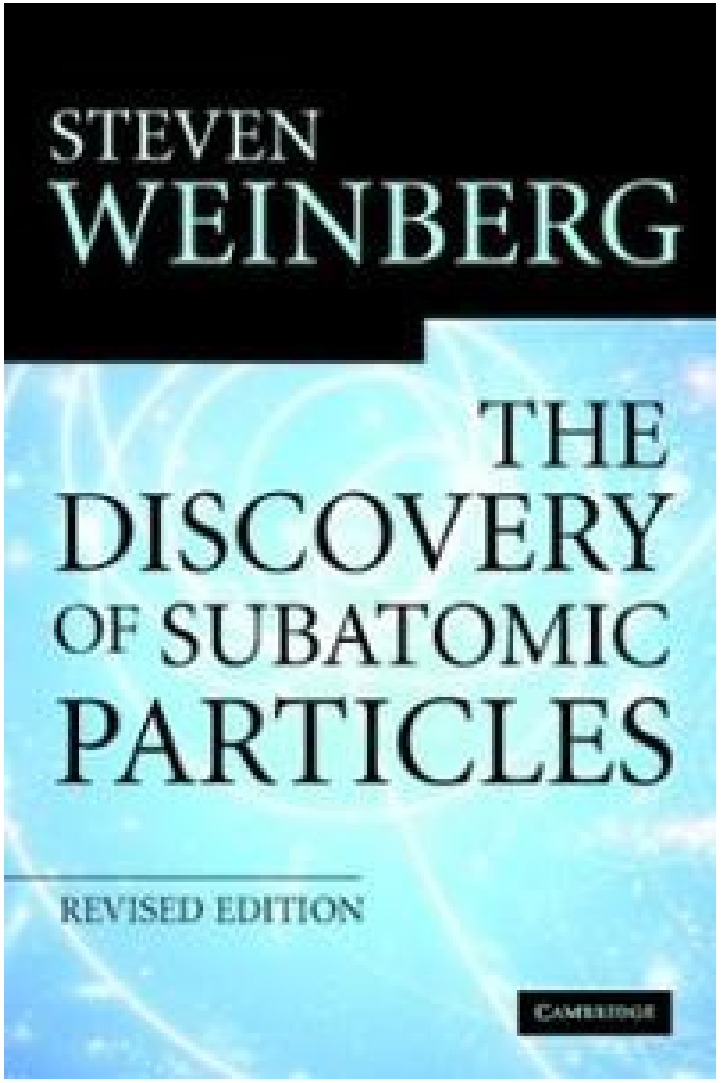
Our opinion

- People are different and in particular learn different, e.g., visual contra verbal learners.
- Try to read a bit in a few books and find the one that fits you the best

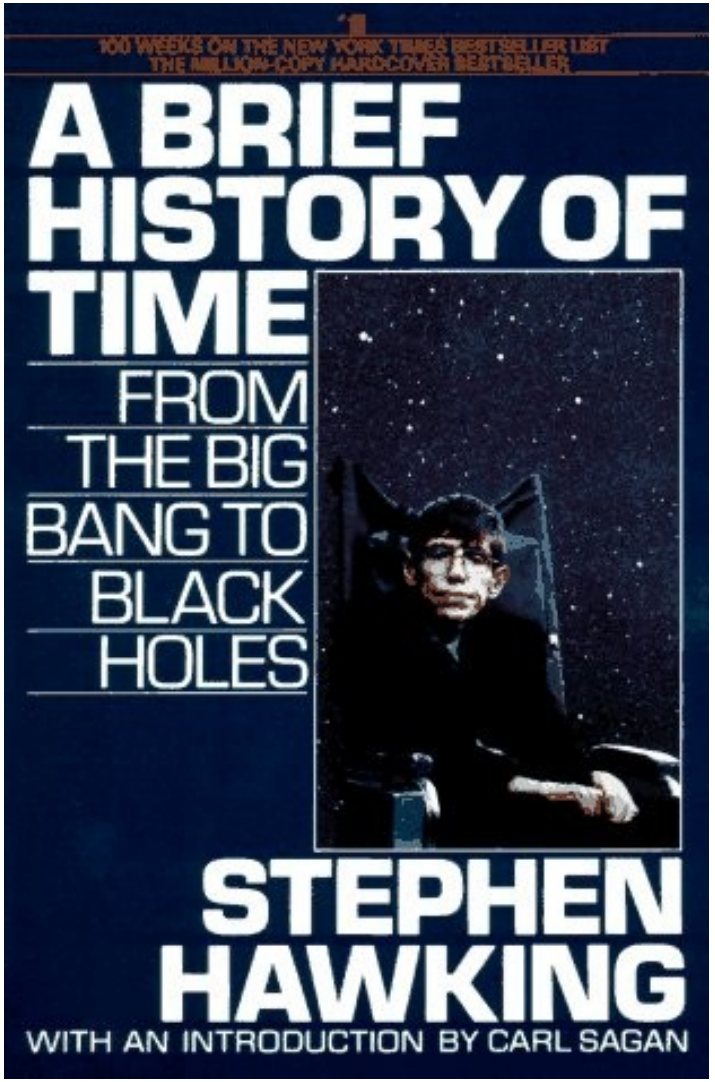
- In some cases you can also have a look at older presentations, e.g., on Peter's web page

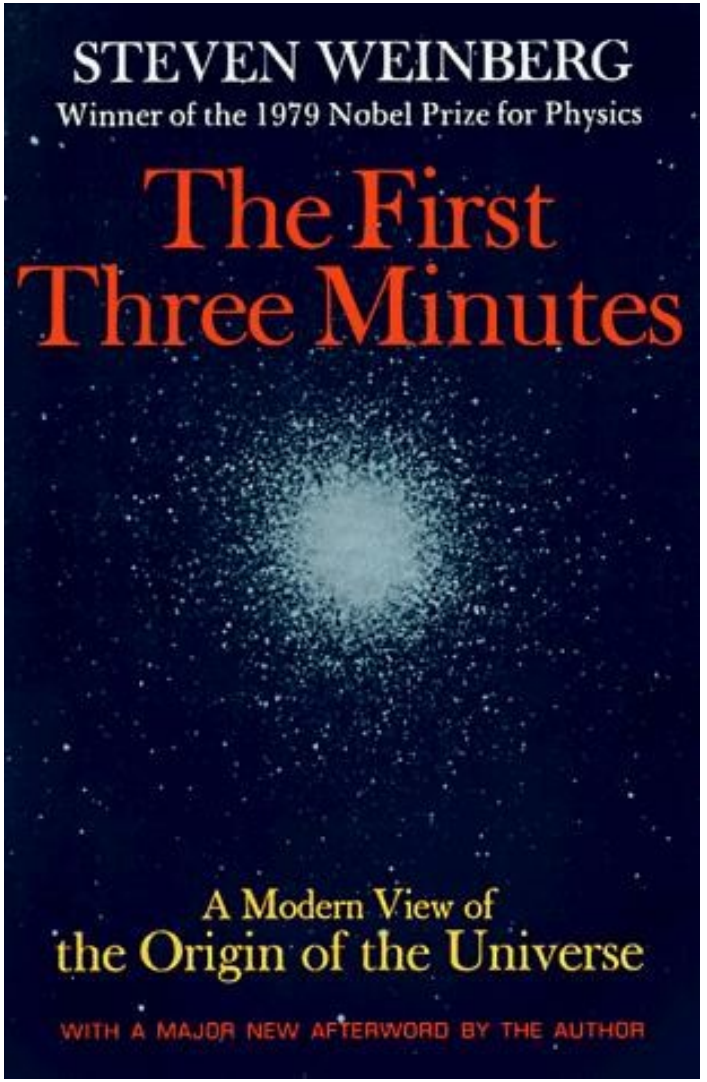
Popular physics (1/4)



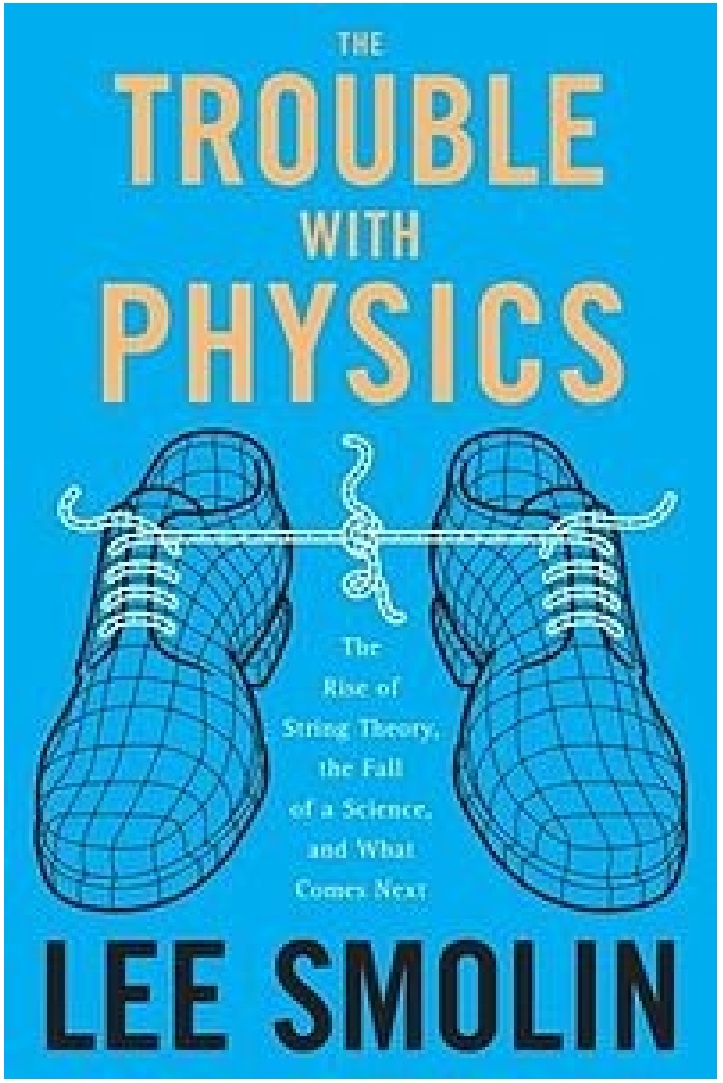


Popular physics (2/4)





Popular physics (3/4)



- Not always popular among theorists but I really recommend it

Popular physics (4/4)

- YouTube contains a lot of nice popular science but also a lot of videos with physics icons

The oral exam

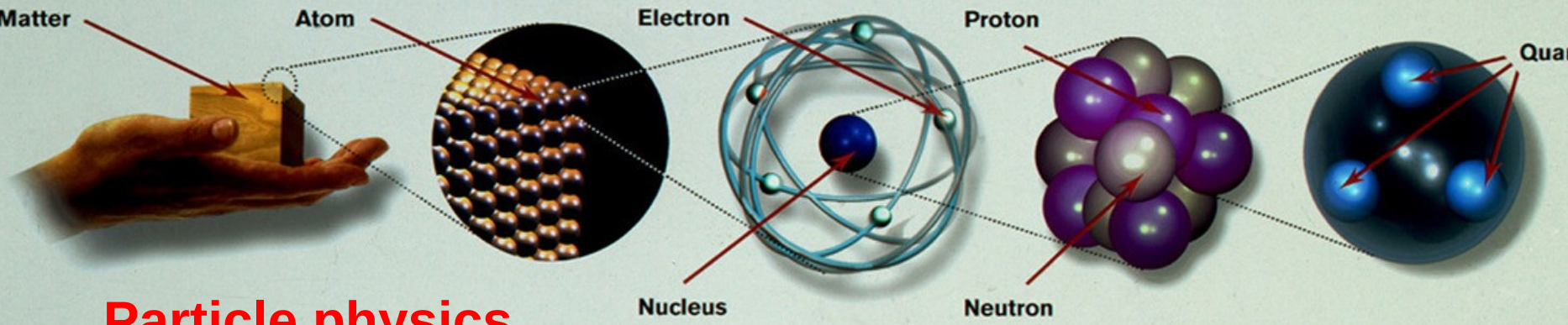
- 30 minutes preparation + 30 minutes examination
- No material can be used in the preparation
- Have to be able to present and discuss details of the standard model and answer 3 randomly selected questions on:
  - A specific particle physics topic
  - Draw one or more Feynman diagrams
  - Detectors or accelerators

Questions?

Why are you here?

- We assume that
  - you are here because you want to be here
  - it is your responsibility to learn/study. The course assumes that the lectures will be followed up by self study: reading and exercise solving
- The course content requirements and specifications are important for a fair examination: They are meant as a minimal knowledge requirement for what we call a physicist
- If you want to pursue a research career you need to develop your own understanding of the material so that you can go beyond the known limits and extend physics

Solid state physics Atomic physics Nuclear physics



Particle physics

Matter particles
All ordinary particles belong to this group

These particles existed just after the Big Bang. Now they are found only in cosmic rays and accelerators

LEPTONS

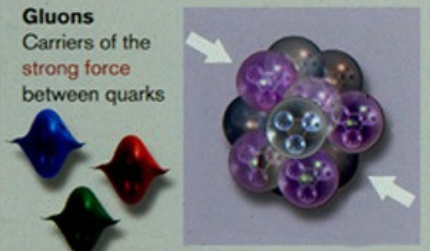
FIRST FAMILY	**Electron** Responsible for electricity and chemical reactions; it has a charge of -1	**Electron neutrino** Particle with no electric charge, and possibly no mass; billions fly through your body every second
SECOND FAMILY	**Muon** A heavier relative of the electron; it lives for two-millionths of a second	**Muon neutrino** Created along with muons when some particles decay
THIRD FAMILY	**Tau** Heavier still; it is extremely unstable. It was discovered in 1975	**Tau neutrino** not yet discovered but believed to exist

QUARKS

Up Has an electric charge of plus two-thirds; protons contain two, neutrons contain one	**Down** Has an electric charge of minus one-third; protons contain one, neutrons contain two
Charm A heavier relative of the up; found in 1974	**Strange** A heavier relative of the down; found in 1964
Top Heavier still	**Bottom** Heavier still; measuring bottom quarks is an important test of electroweak theory

Force particles
These particles transmit the four fundamental forces of nature although gravitons have so far not been discovered

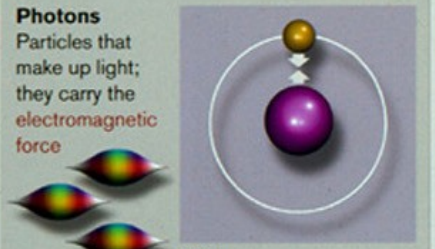
Gluons
Carriers of the strong force between quarks



Felt by: quarks

The explosive release of nuclear energy is the result of the strong force

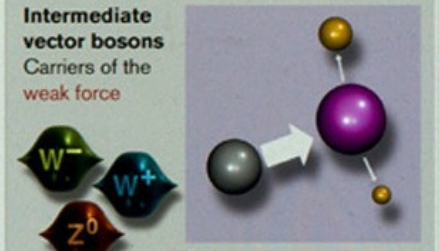
Photons
Particles that make up light; they carry the electromagnetic force



Felt by: quarks and charged leptons

Electricity, magnetism and chemistry are all the results of electro-magnetic force

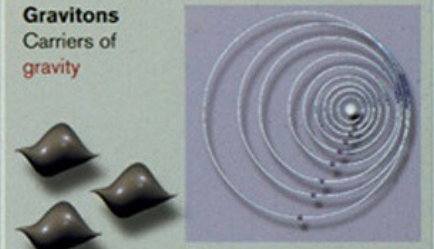
Intermediate vector bosons
Carriers of the weak force



Felt by: quarks and leptons

Some forms of radio-activity are the result of the weak force

Gravitons
Carriers of gravity

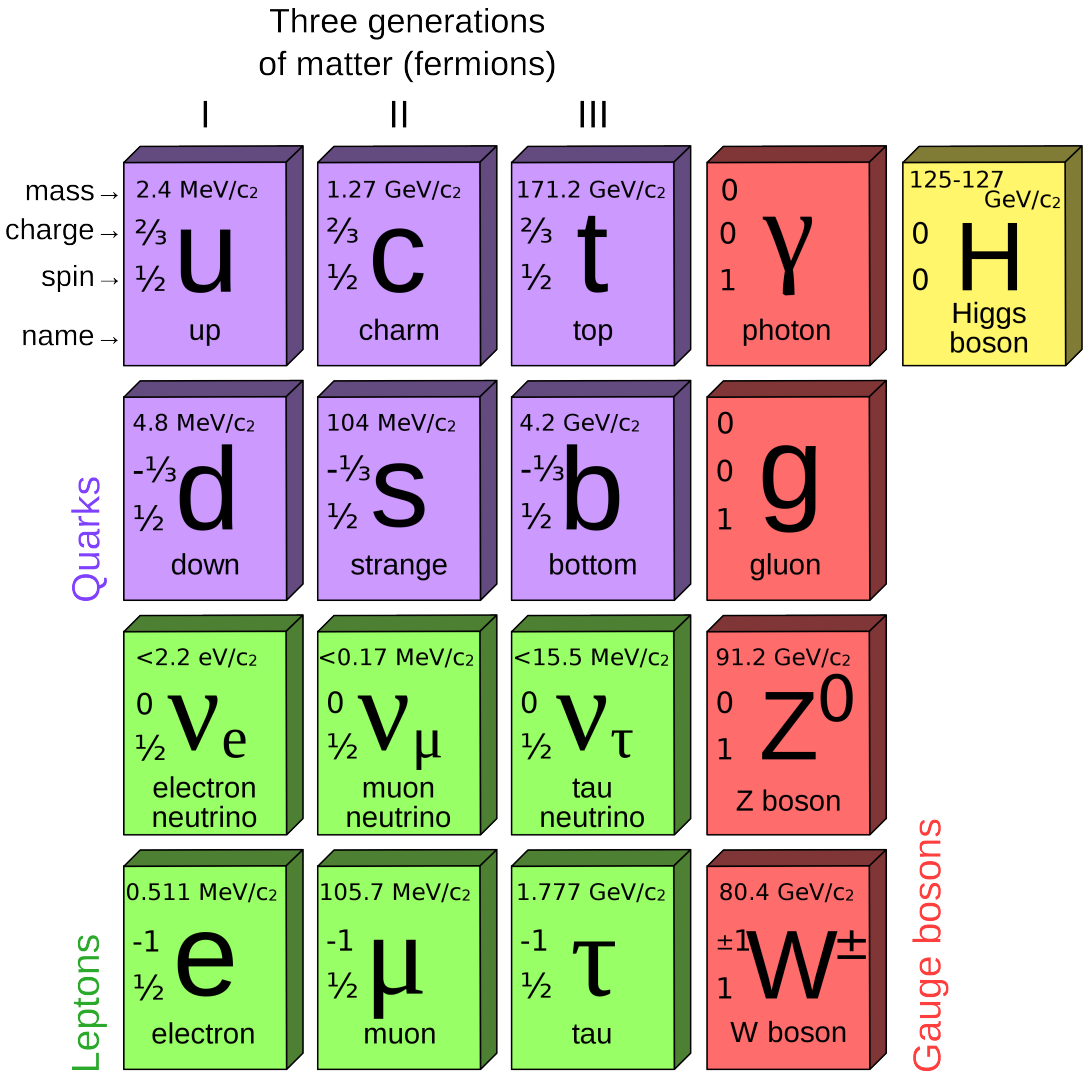


Felt by: all particles with mass

All the weight we experience is the result of the gravitational force

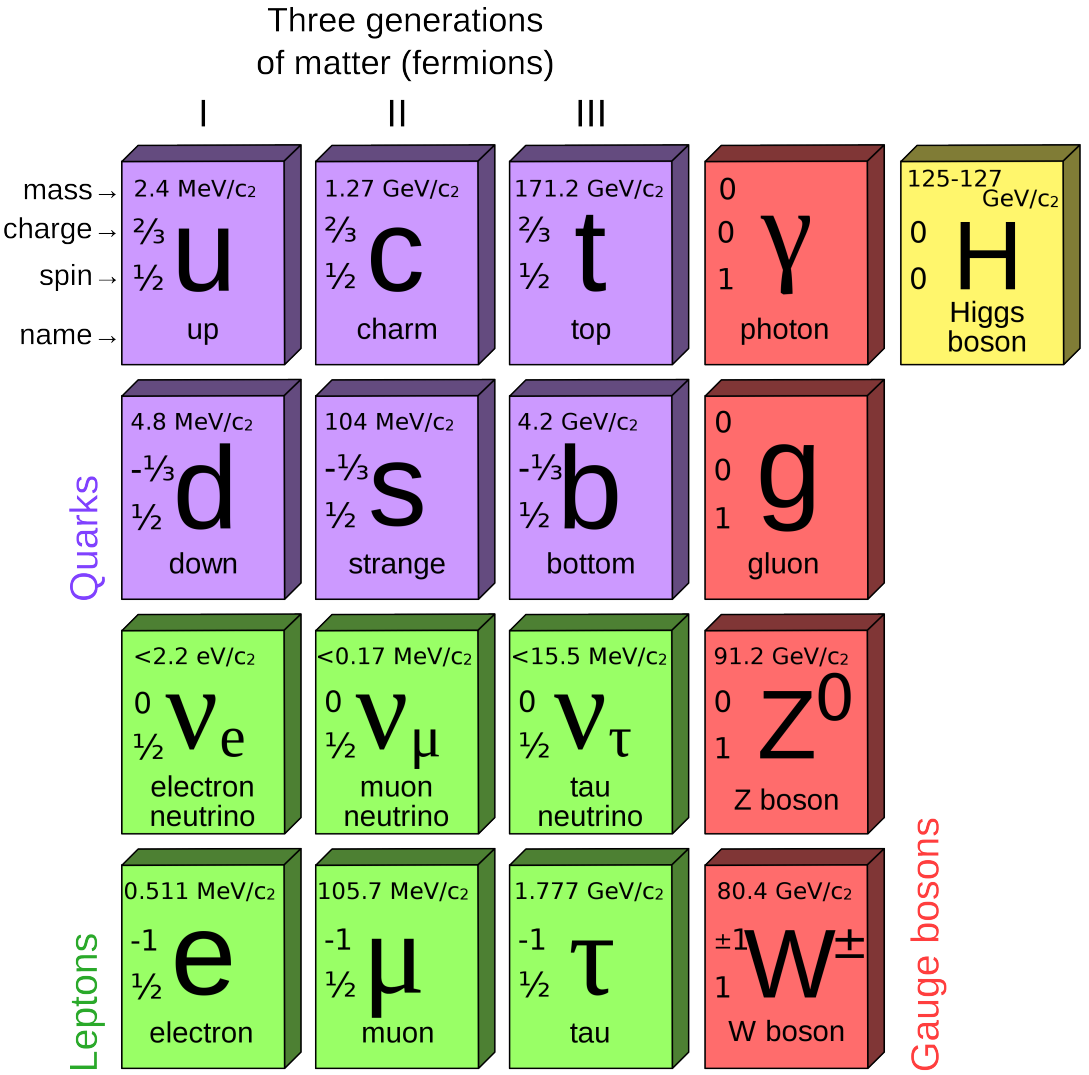
GRAPHICS: PETER CROWTHER

The particle zoo



The main goal of the course is to give you an understanding of the particle zoo and how it works together as the standard model – the underlying framework for all known physics processes

What particles do you know?



Goal of today's and tomorrow's lecture

- Introduce four momentum vectors and Feynman diagrams which are important tools for our understanding of the standard model