

De la relativitat d'Einstein al bosó de Higgs

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Francesc Aragó, Estagell, 1798



Benjamin Thompson, 1753
Comte Rumford

$$c' = c ?$$

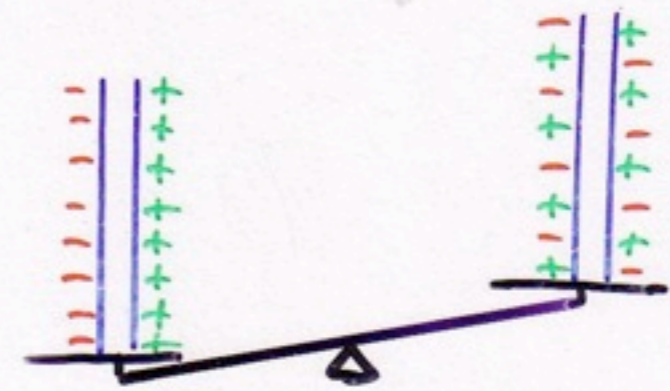
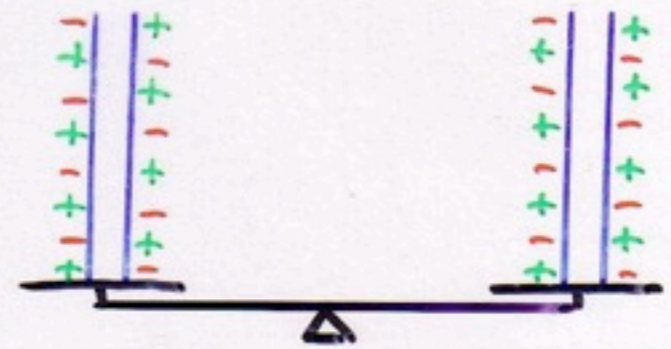
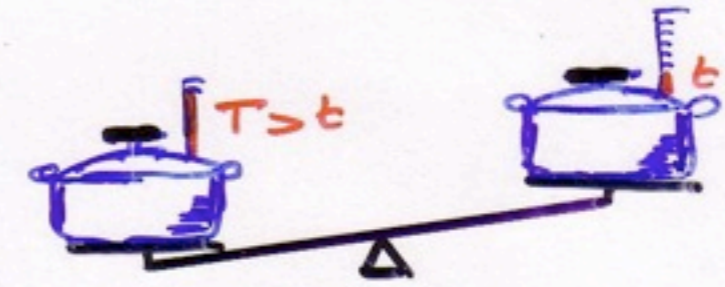
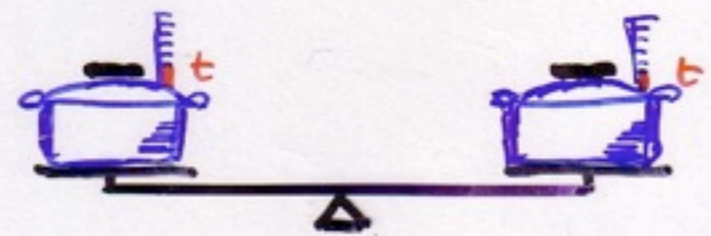
$$c = 299\,792\,458 \text{ m/s}$$

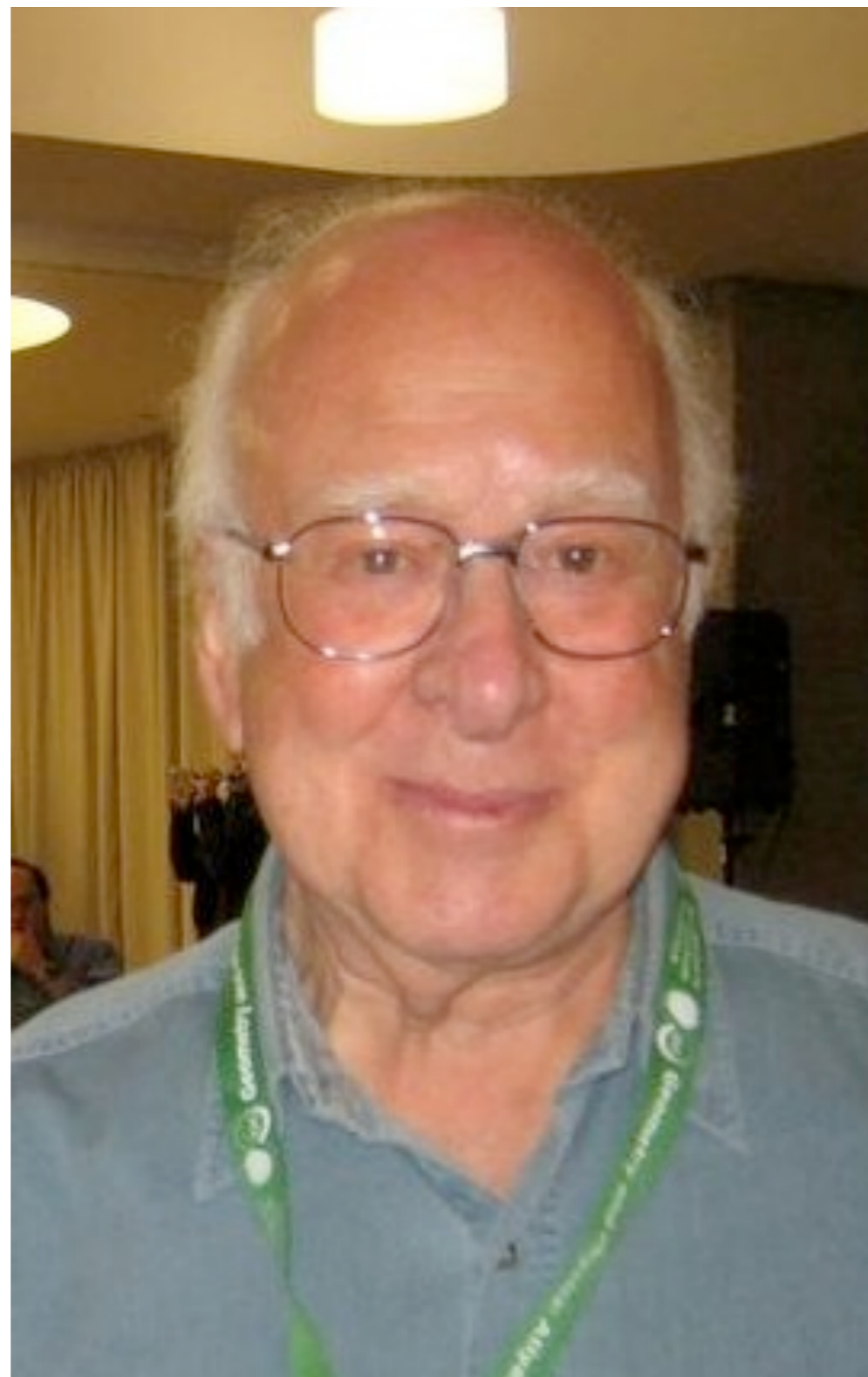
$$E_0 = mc^2 ?$$

$$1 \text{ cal} \longleftrightarrow 4,5 \times 10^{-17} \text{ kg}$$



$$E_0 = mc^2$$

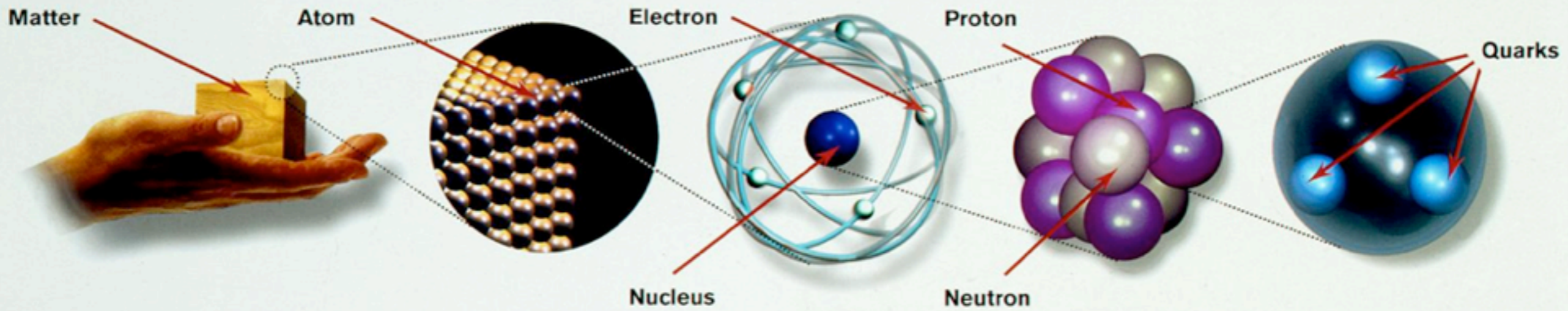




Peter Higgs (1929), predicció feta el 1964



CERN, Ginebra, i ICHEP, Austràlia: 4 de juliol de 2012



Matter particles

All ordinary particles belong to this group

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

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

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	

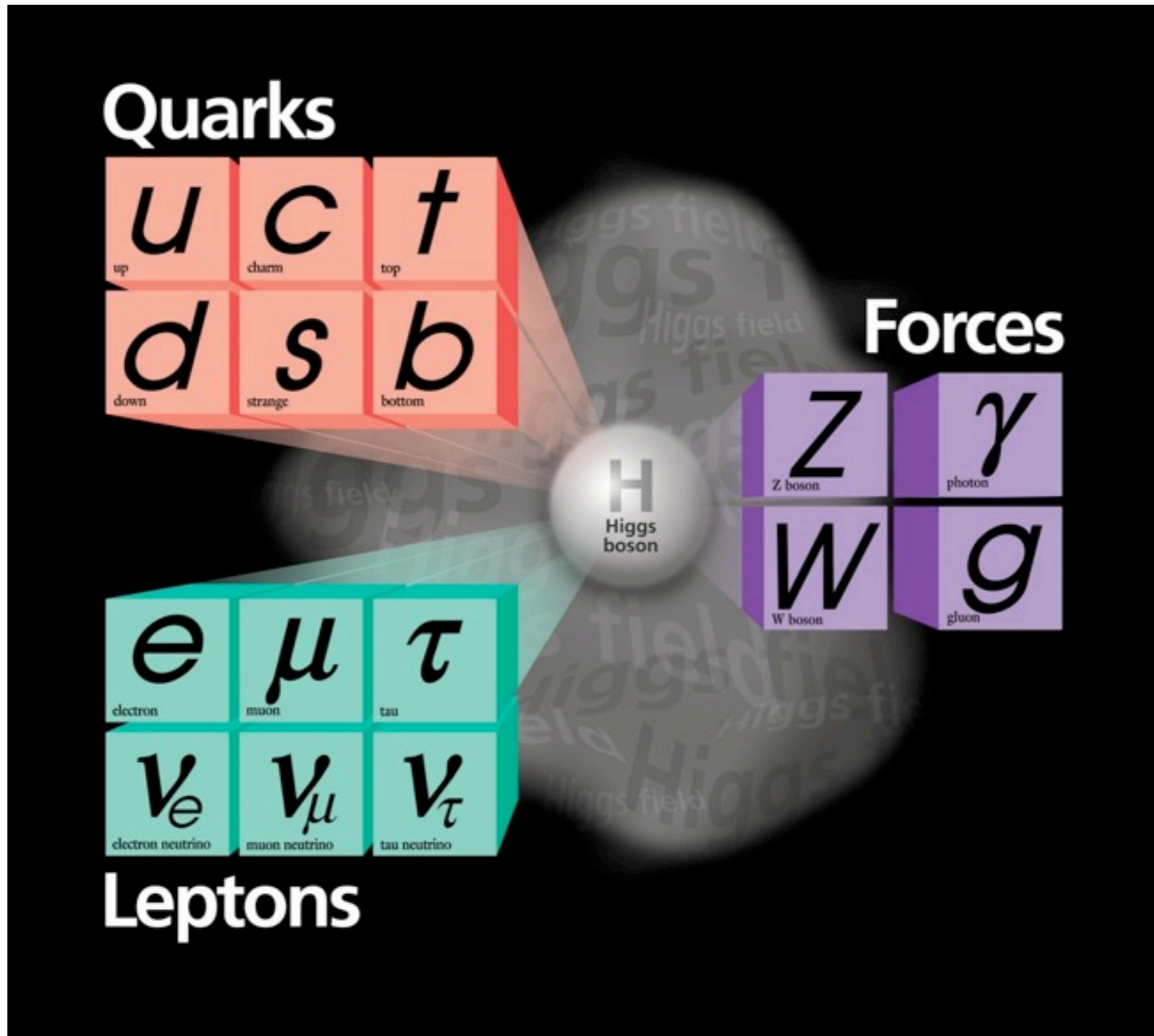
Force particles

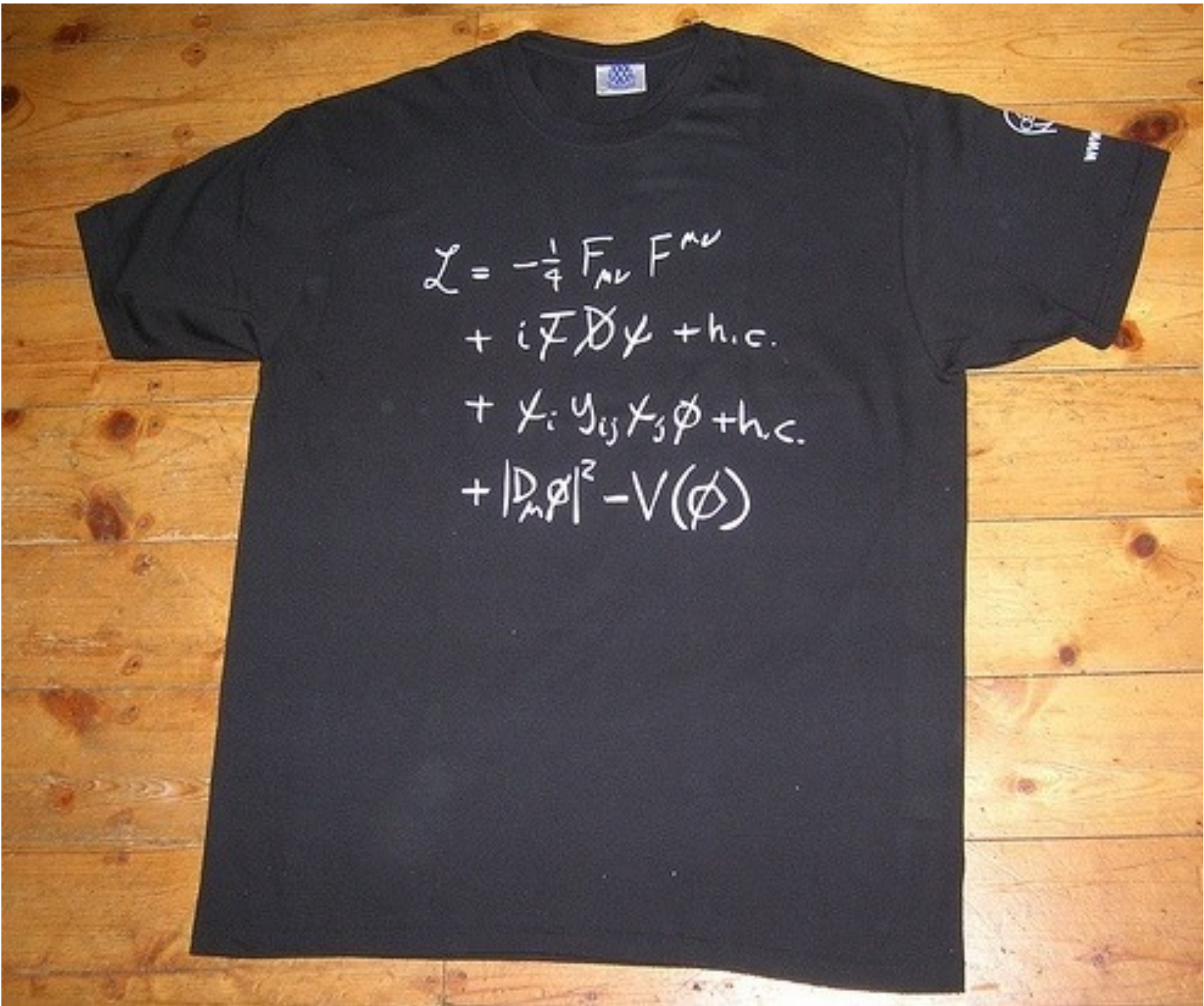
These particles transmit the four fundamental forces of nature although gravitons have so far not been discovered

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
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Model estàndard de partícules elementals i forces fonamentals

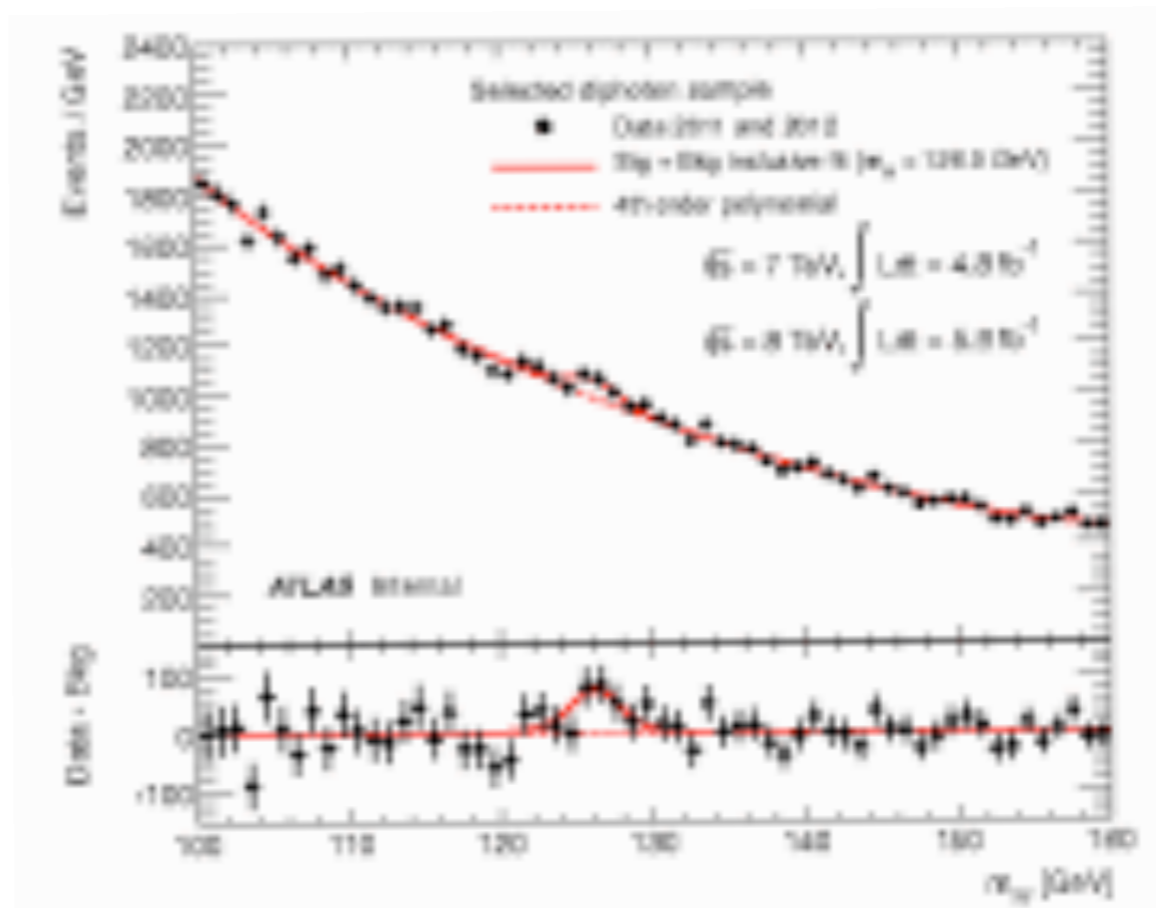
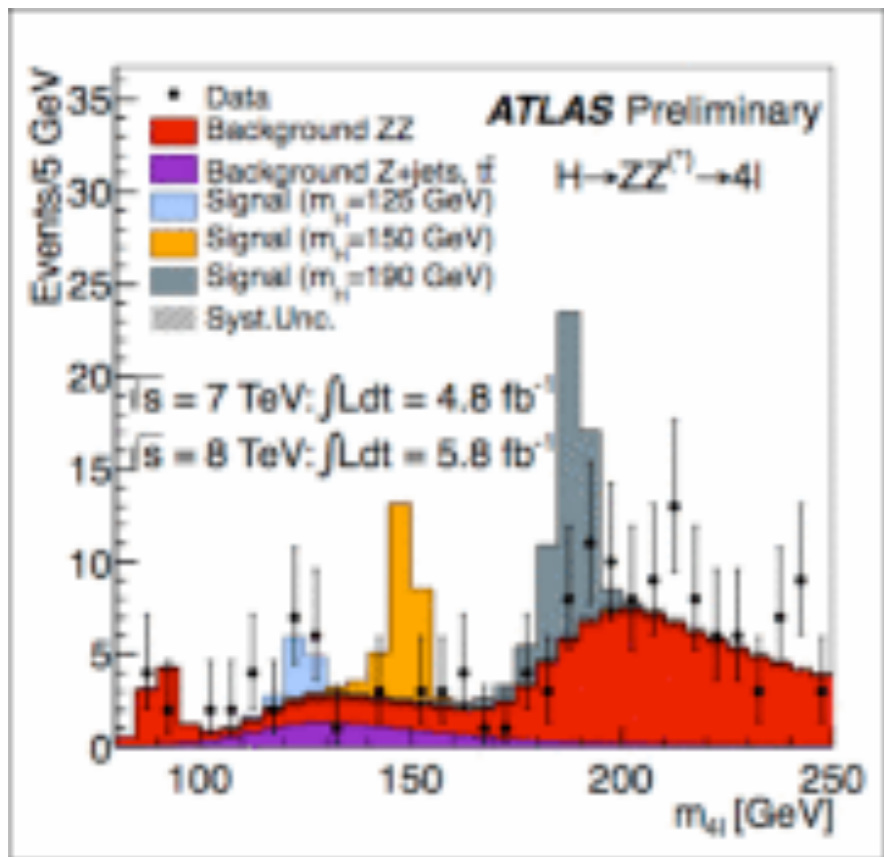
Model estàndard de partícules elementals (cal afegir-hi els antiquarks i antileptons)



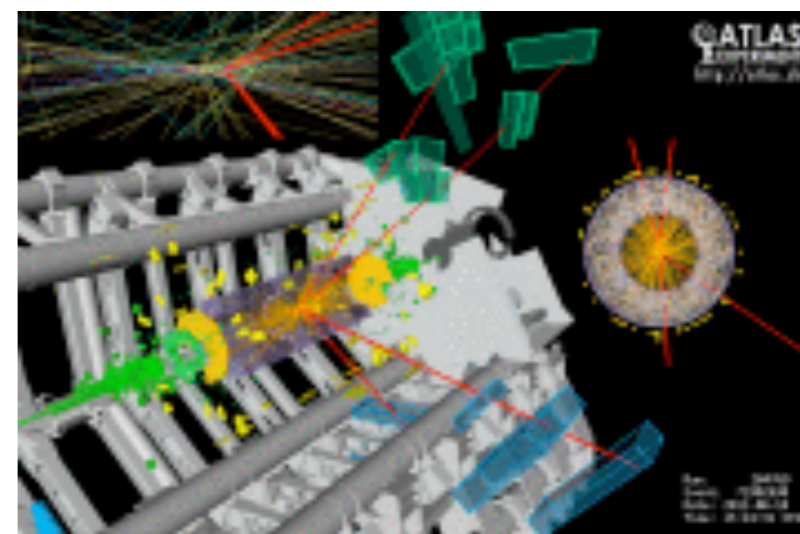
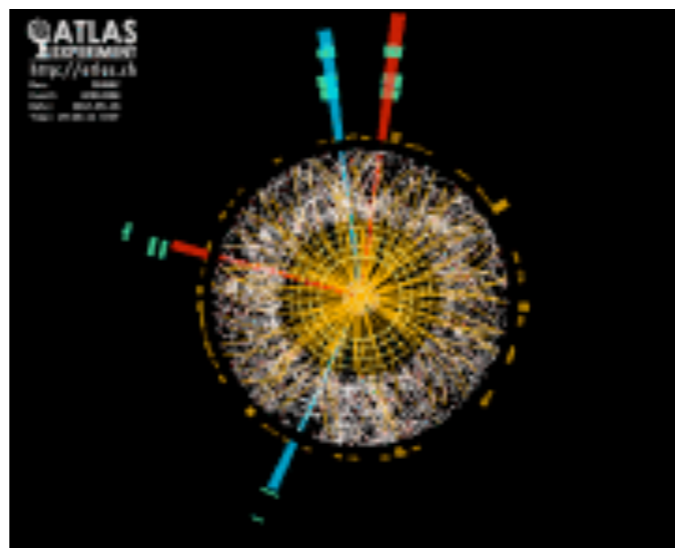
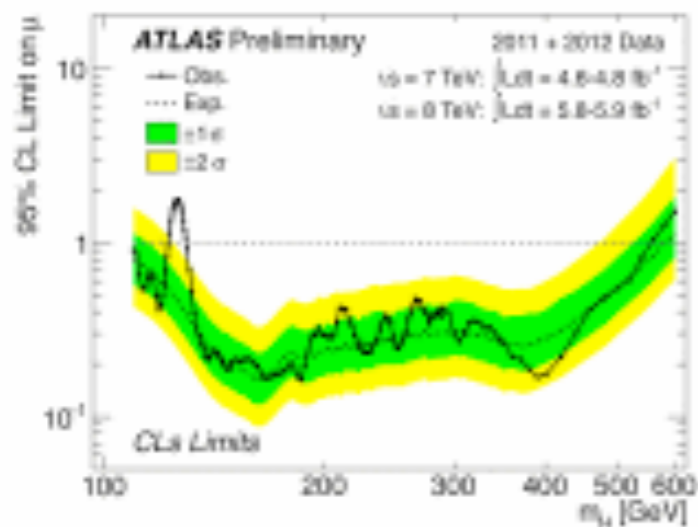


The image shows a black t-shirt laid flat on a light-colored wooden surface. The t-shirt has a small white tag at the collar and a small logo on the right sleeve. The mathematical formulas are written in white ink on the front of the t-shirt.

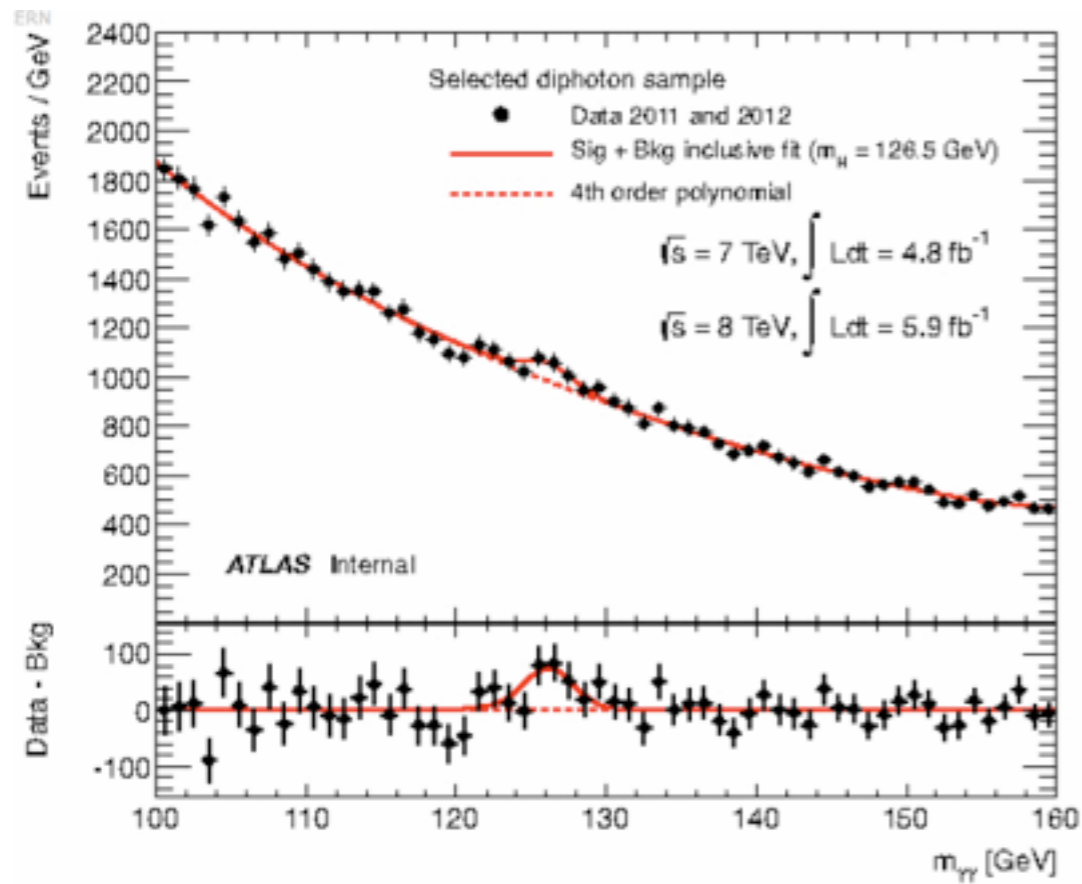
$$\begin{aligned}\mathcal{L} &= -\frac{1}{4} F_{\mu\nu} F^{\mu\nu} \\ &+ i\bar{\psi}\not{D}\psi + \text{h.c.} \\ &+ \chi_i y_{ij} \chi_j \phi + \text{h.c.} \\ &+ |D_\mu \phi|^2 - V(\phi)\end{aligned}$$



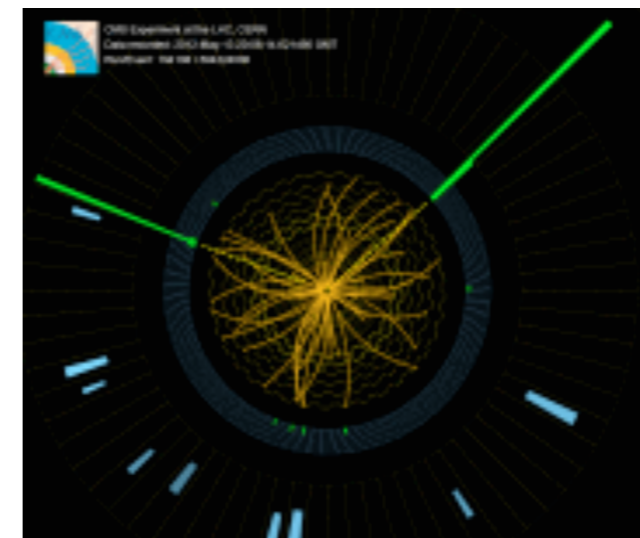
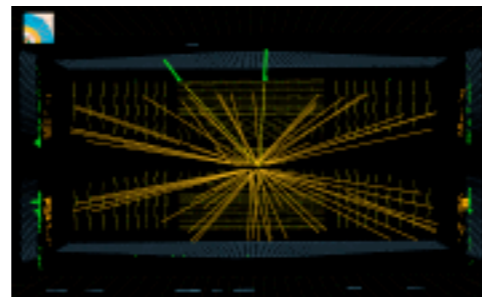
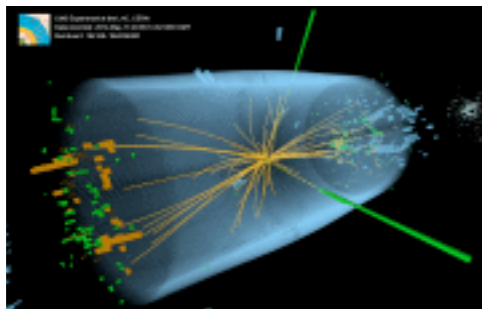
ATLAS: H to ZZ to 4l



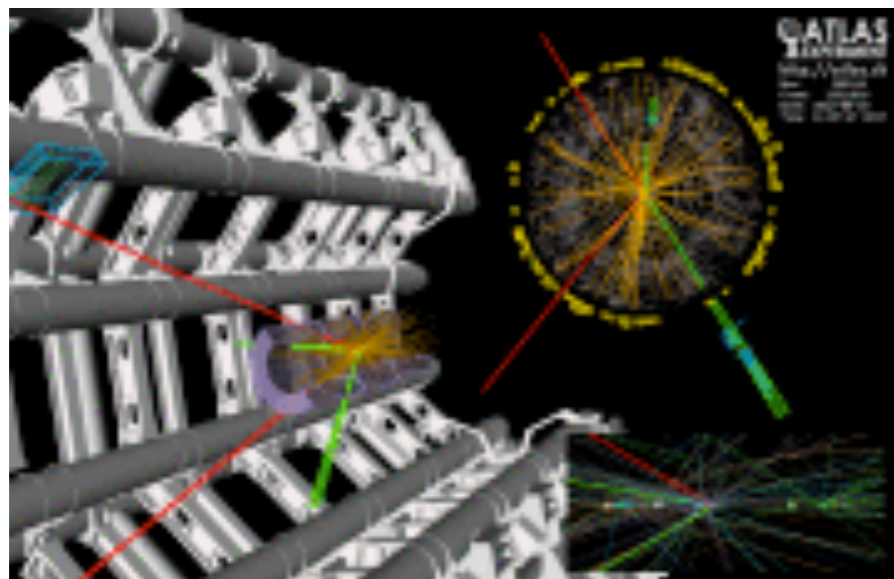
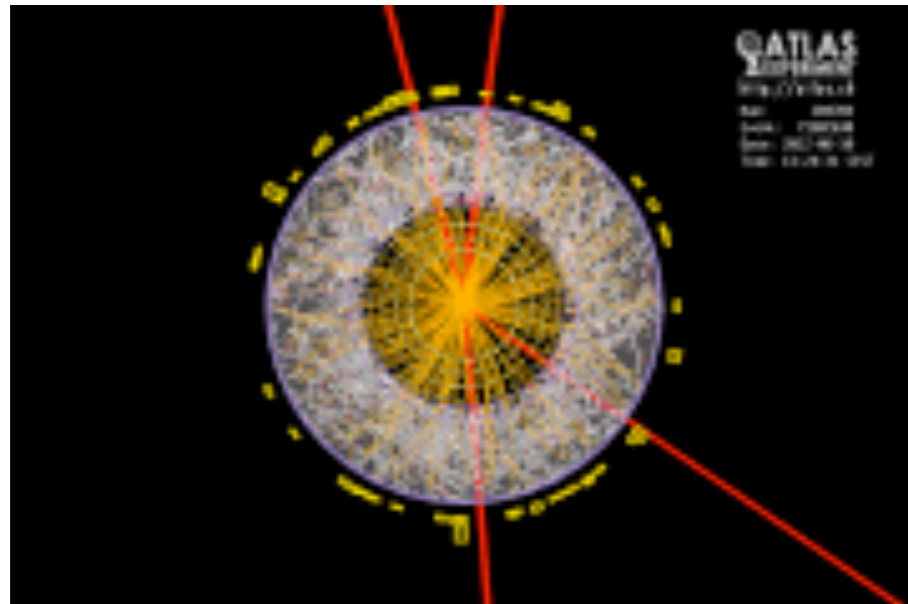
ATLAS: H to gamma gamma



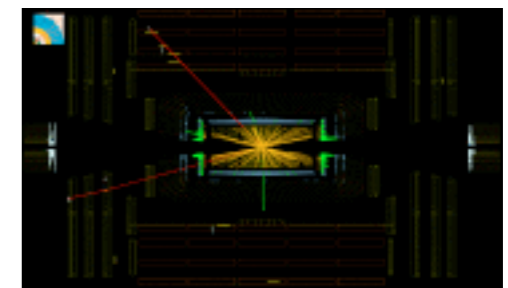
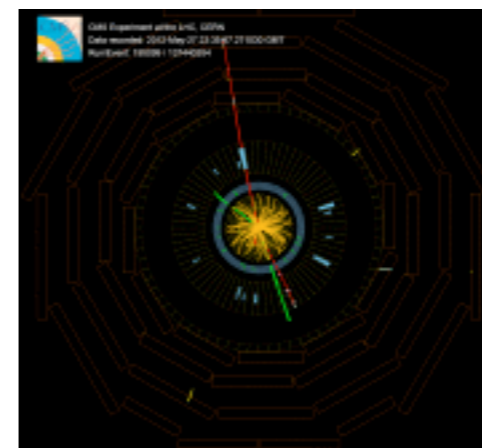
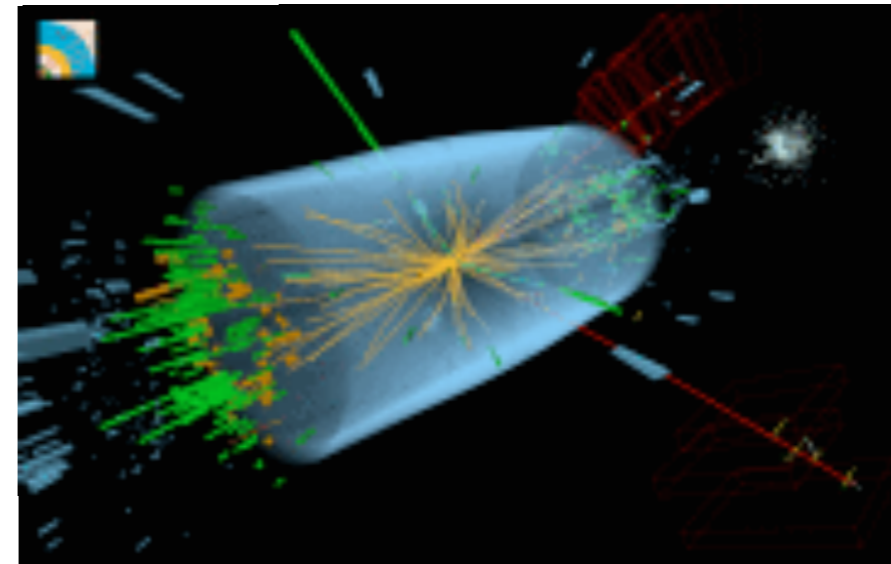
CMS: H to gamma gamma



ATLAS



CMS



ZZ to $2e2\mu$

