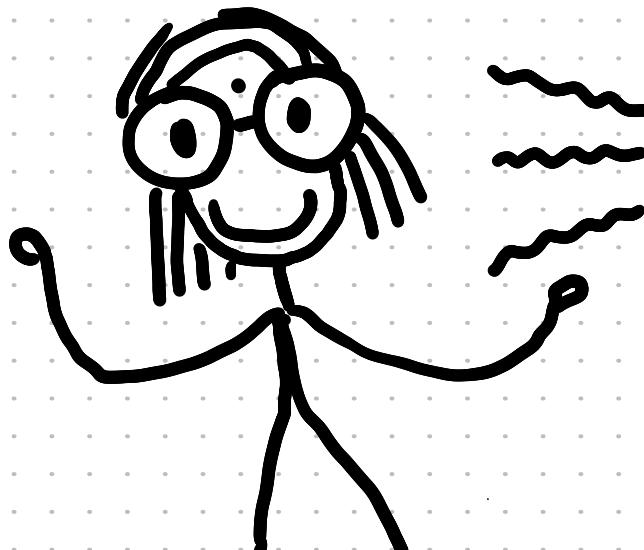


# introduction to particle physics :)

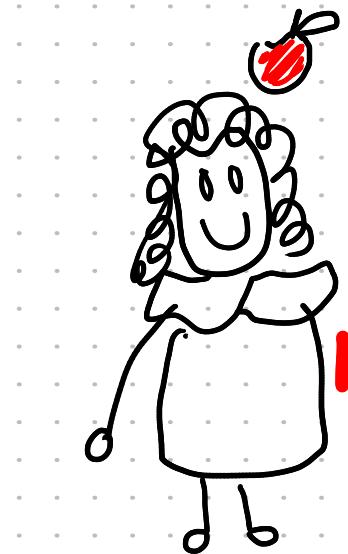


sneha vireshwar dixit

sdixit2@washcoll.edu

What do particle physicists study?

What is particle physics about?



CLASSICAL  
MECHANICS

'SLOW'  
( $\ll 3 \times 10^8$  m/s)



QUANTUM  
MECHANICS



'BIG'  
( $\gg 10^{-9}$  m)

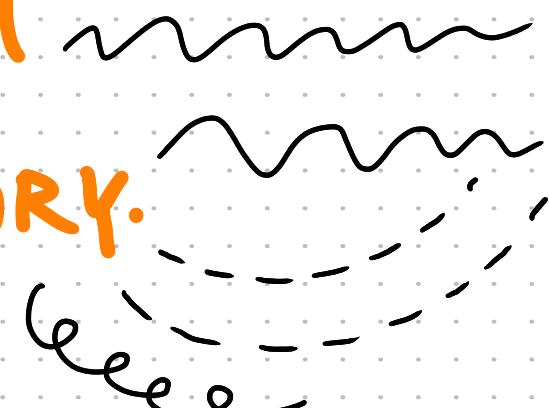
RELATIVISTIC  
MECHANICS



FAST  
( $\sim 3 \times 10^8$  m/s)

QUANTUM

FIELD THEORY.



# ENERGY + MASS IN PARTICLE PHYSICS



DEALING  
W/ V. SMALL  
LENGTHS

$$\hbar = c = 1$$

→ TRAVELLING @  
V. HIGH SPEEDS.

$$\cancel{E=mc^2}$$

$$E^2 = p^2c^2 + m^2c^4$$

→ E, m, p HAVE SAME UNIT

→ E, m, p MEASURED  
IN eV.

What is our universe made up of?

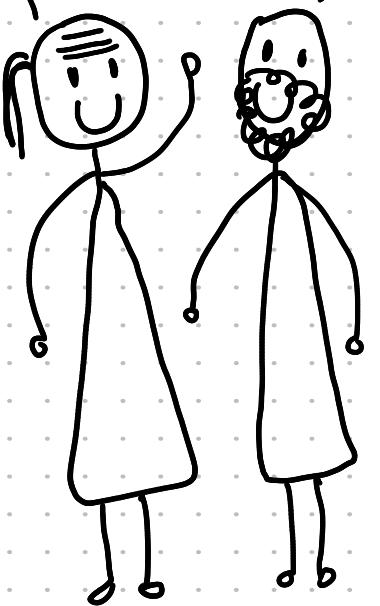
What is the most fundamental particle?

# What is the most fundamental particle?

'INDIVISIBLE'  
PARTICLES!

5 NATURAL  
ELEMENTS!

ATOMS!



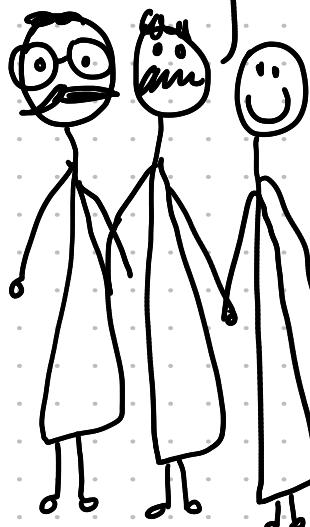
ANCIENT INDIA/GREECE

PROTONS, NEUTRONS  
& ELECTRONS!



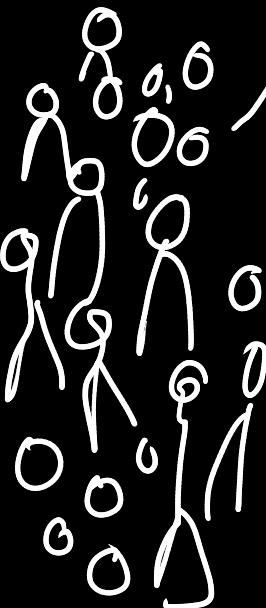
1800s - DALTON

1900s - THOMSON,  
RUTHERFORD, CHADWICK.



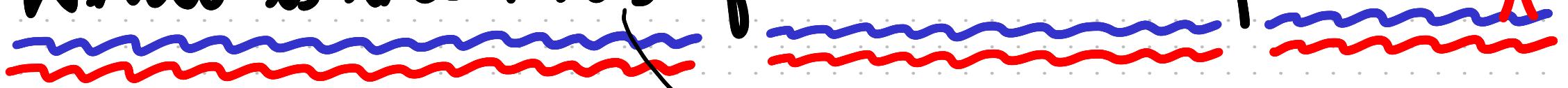
1900s - 2012  
MODERN  
PHYSICISTS.

WELL  
ACTUALLY...



so far

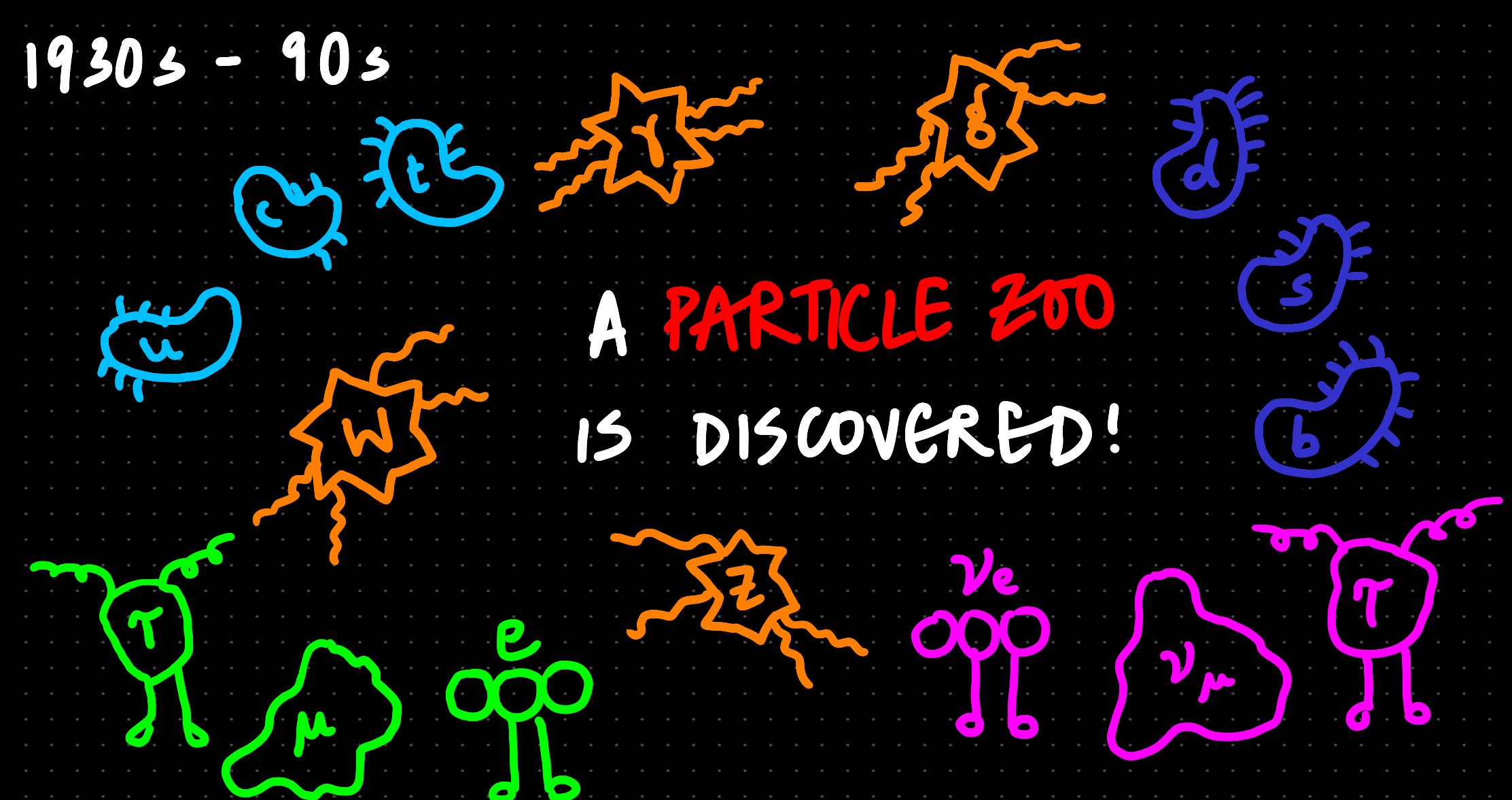
What is the most fundamental particle?



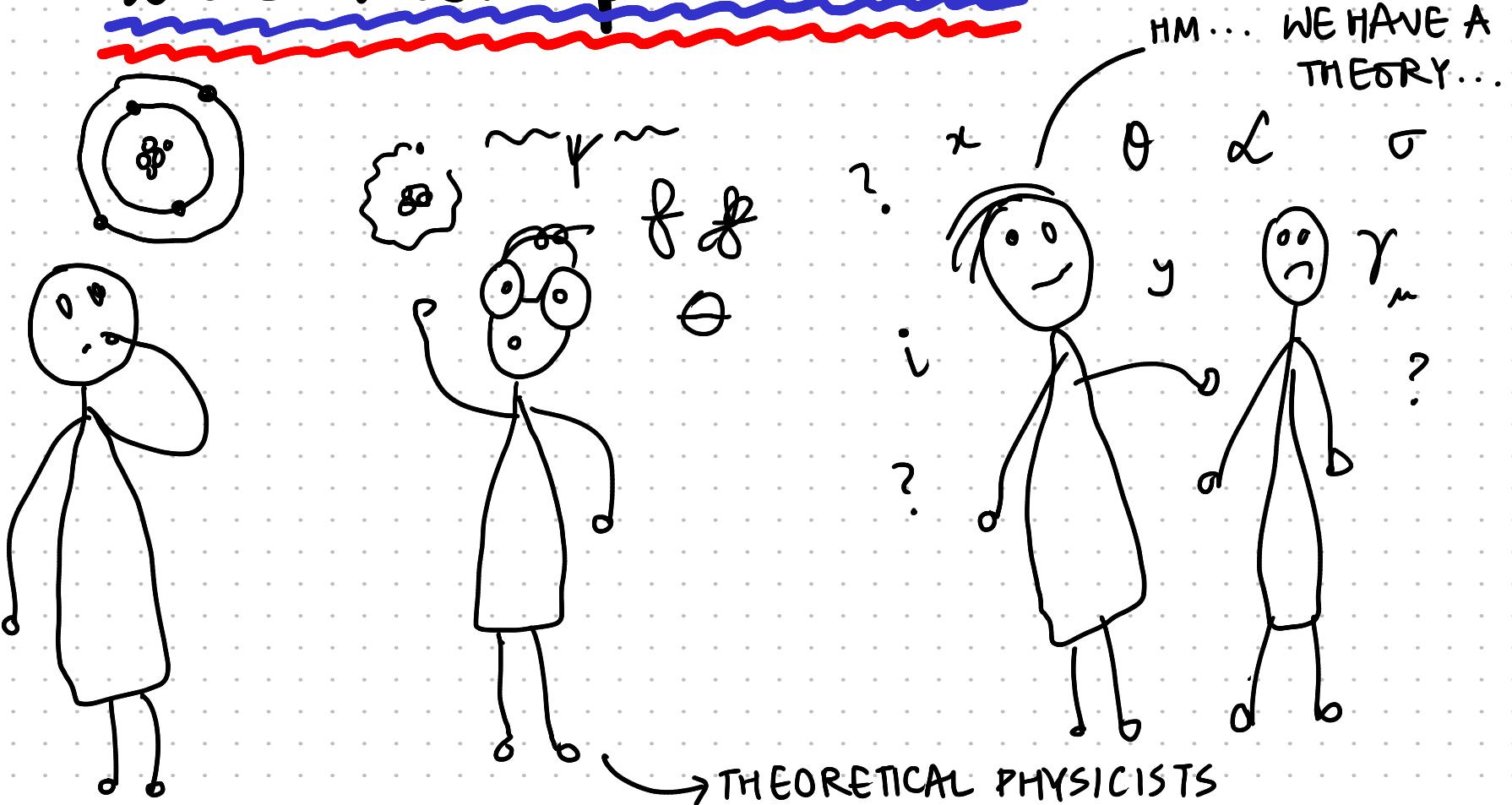
MOST FUNDAMENTAL  
IS A MOVING  
TARGET.

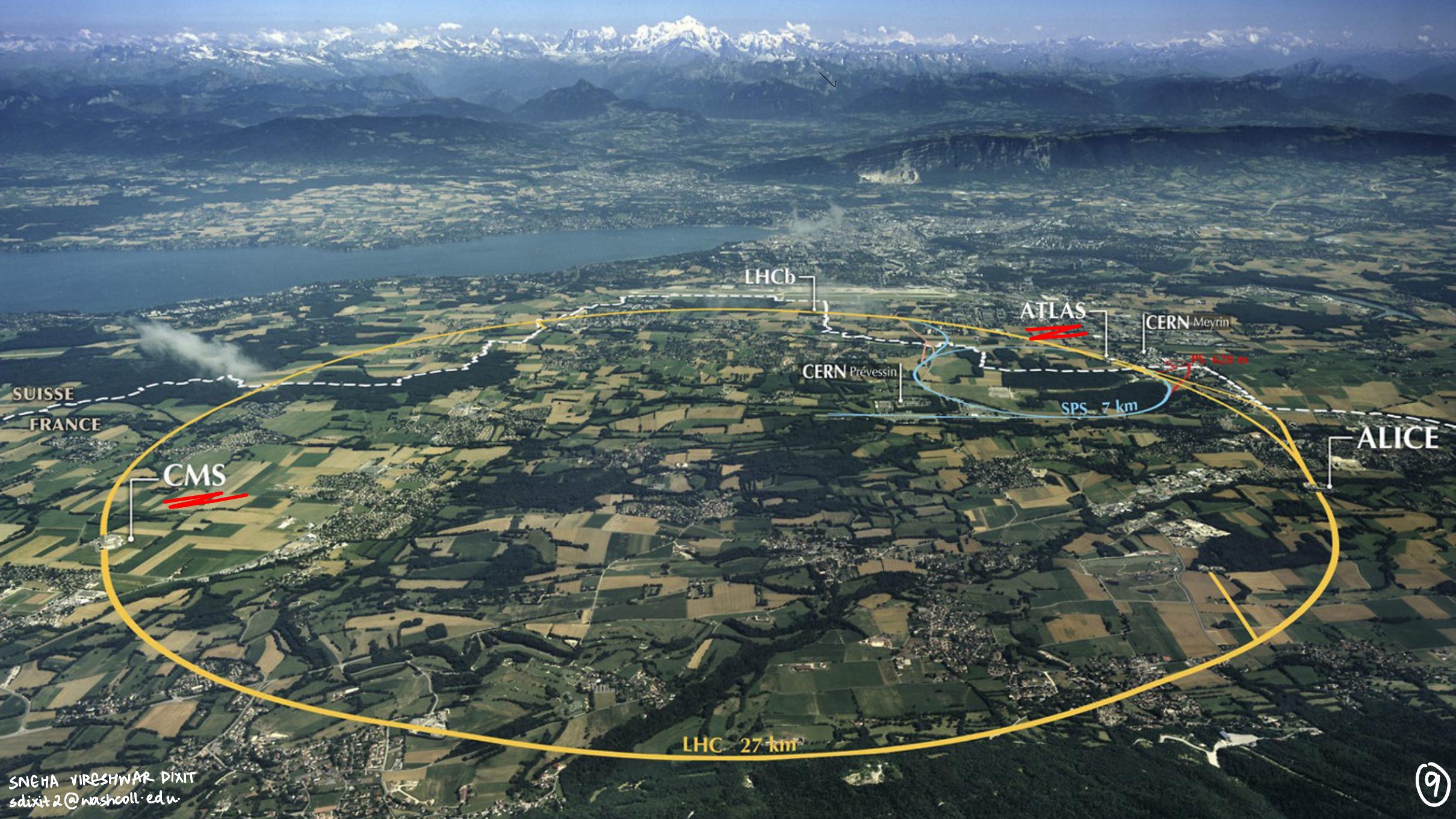
1930s - 90s

A PARTICLE ZOO  
IS DISCOVERED!

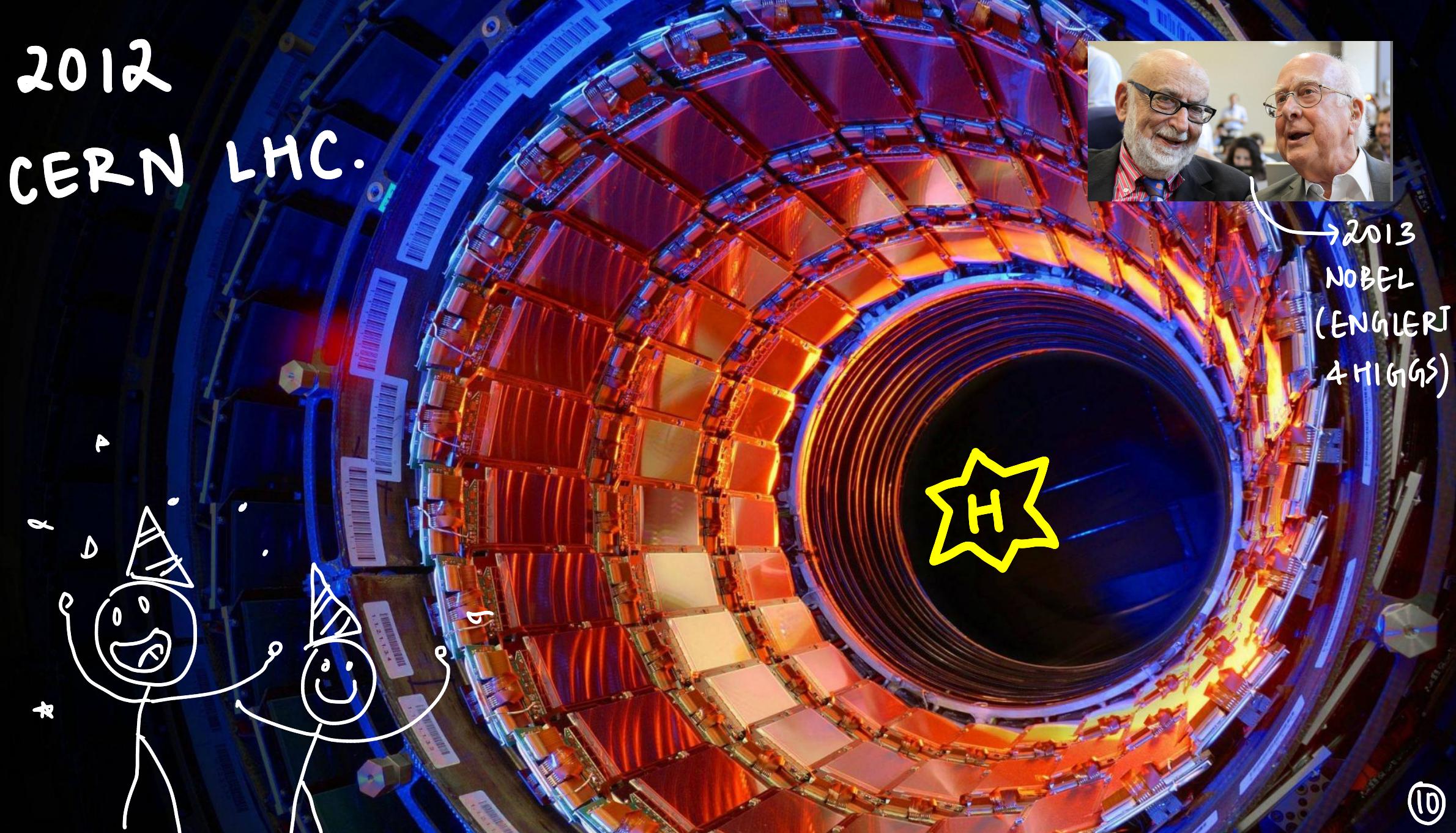


# How do we make sense of all these new particles?

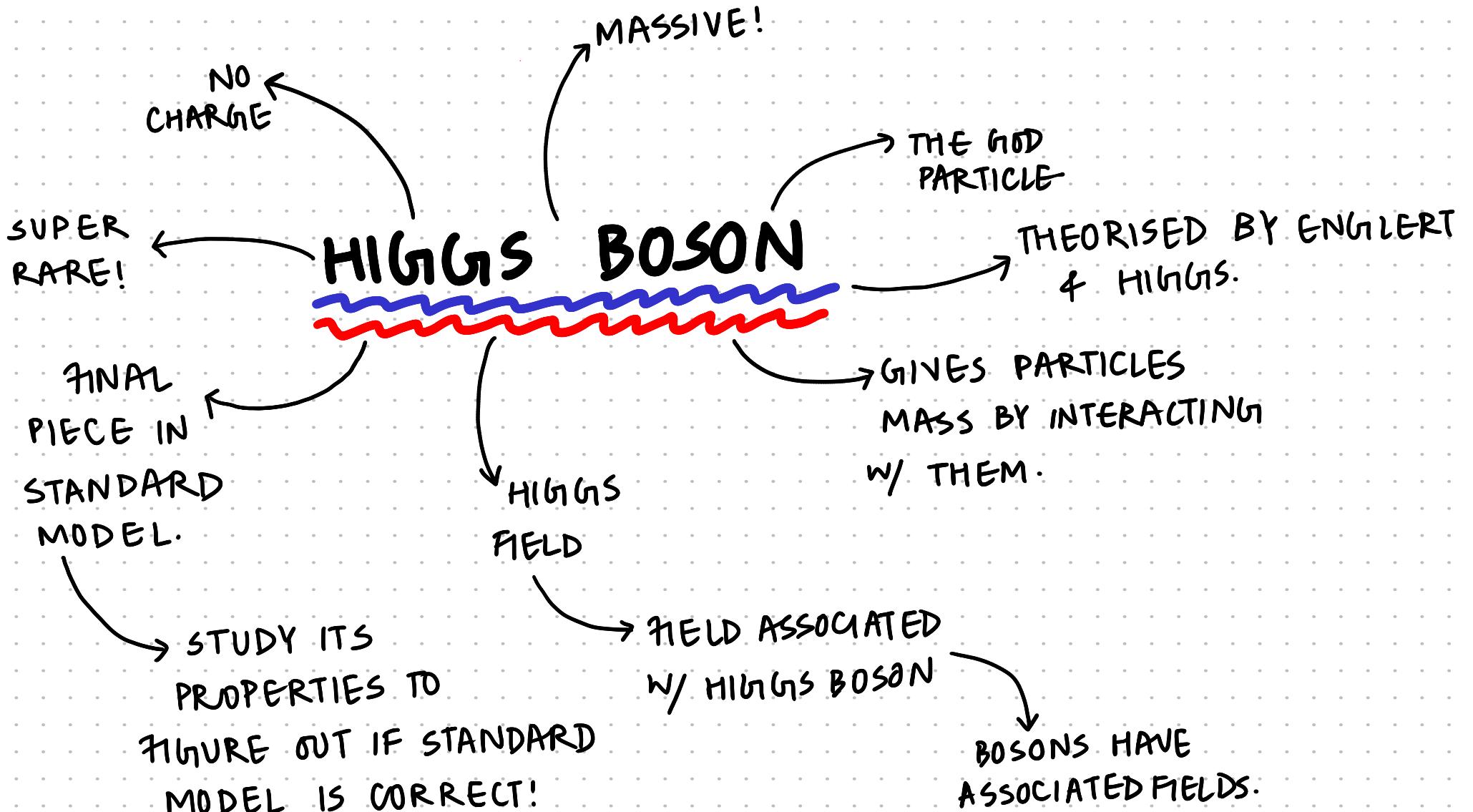




2012  
CERN LHC.



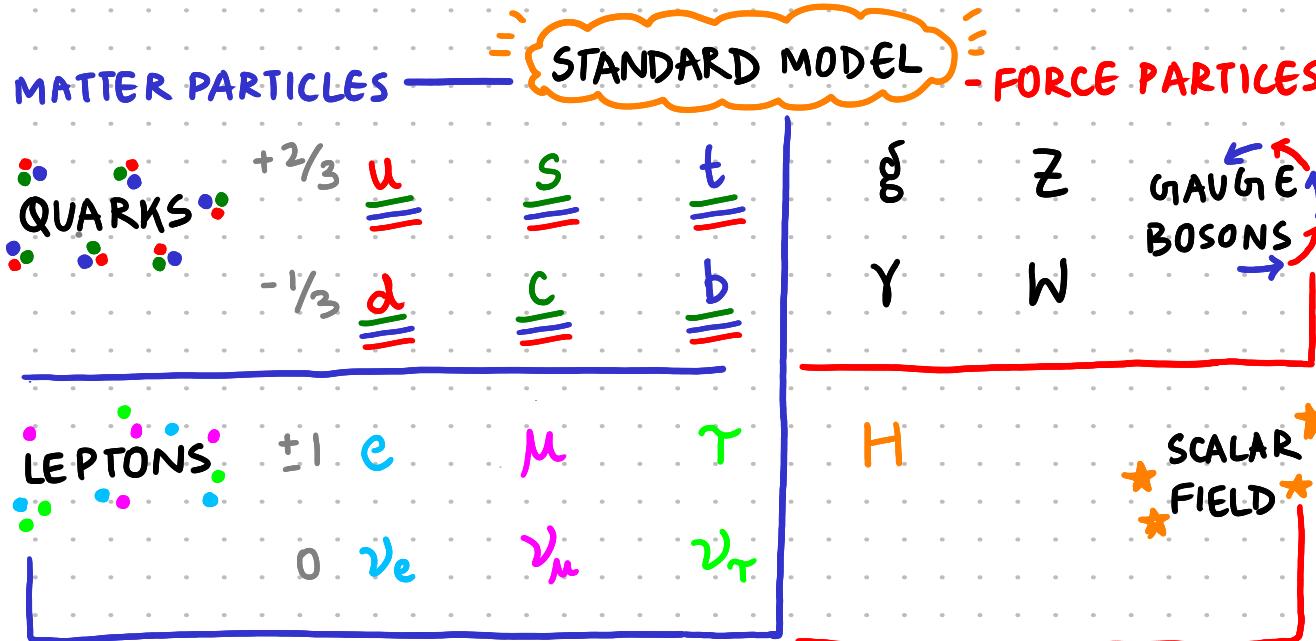
→ 2013  
NOBEL  
(ENGLERT  
& HIGGS)



# STANDARD MODEL OF PARTICLE PHYSICS

UNIVERSE = made up of MATTER/ENERGY that interacts via FORCES

EVERYTHING  
IS A PARTICLE!  
(AND A WAVE!)



gravity?

dark energy?

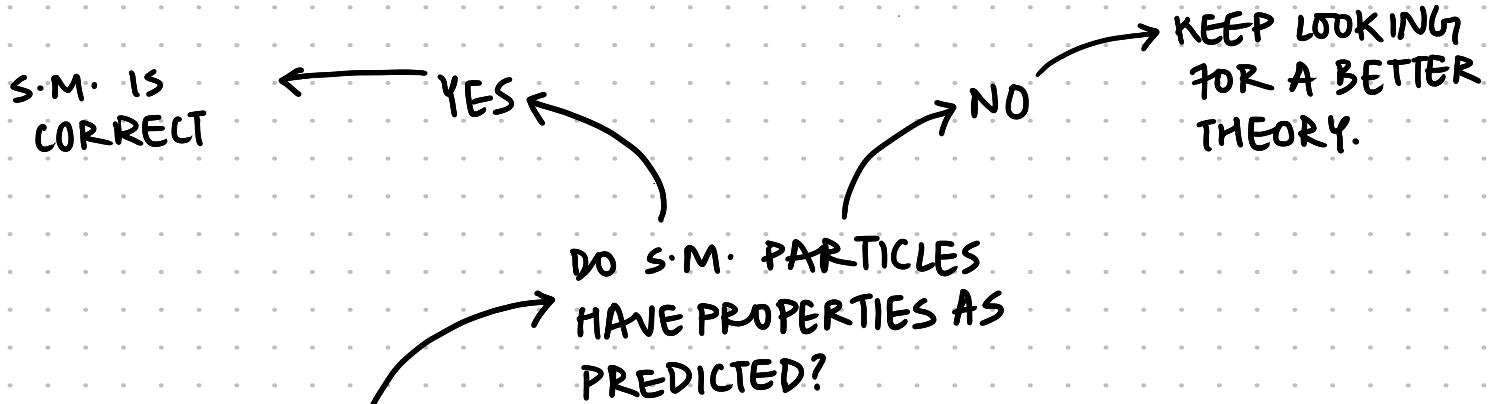
dark matter?

new physics?

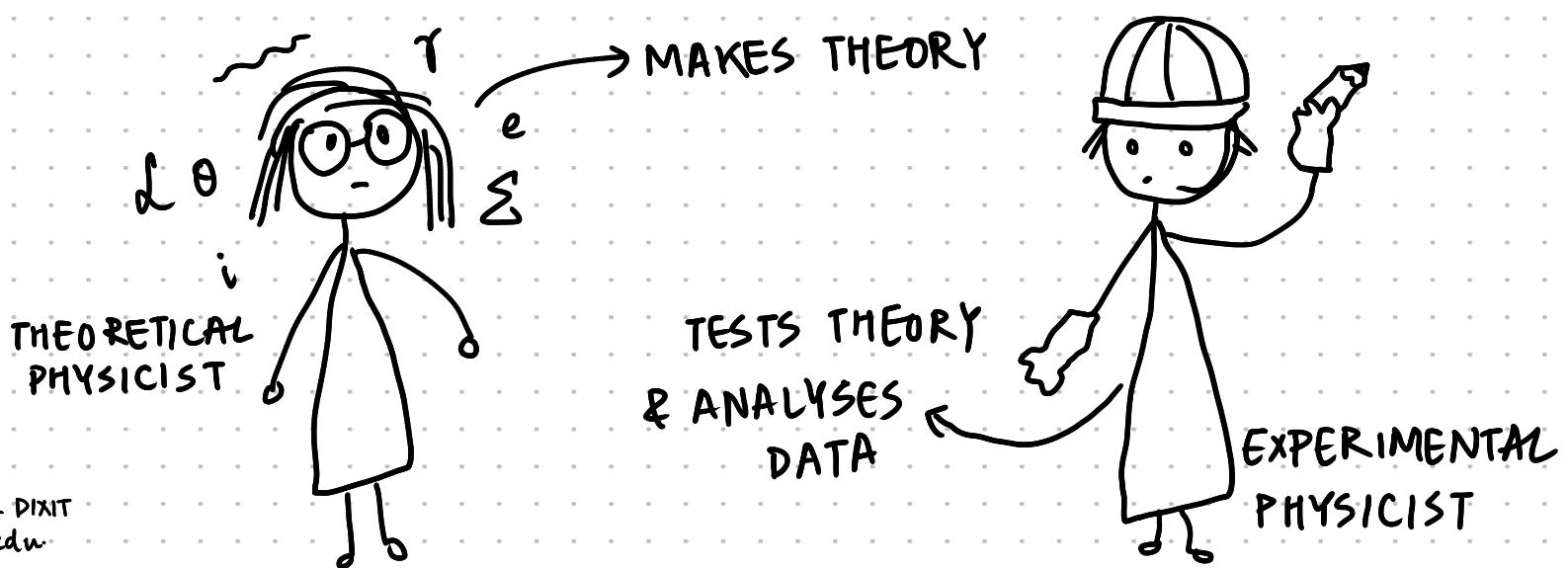
!BEYOND STANDARD MODEL!

What happens next?

Is the standard model the best we have?



We can test the standard model!



# What do we not know yet?

