



# “Particle Physics for Babies”

Louie Corpe (CERN)

IPPOG Meeting, 11 May 2022

# Introduction

- Last November at the IPPOG workshop , I presented an idea for a novel outreach project:
  - *A particle physics baby book!*
- Received a lot of excellent feedback from the IPPOG community, which has helped to refine the concept, and take it to the next level.
- Books are currently in procurement, hope to have 1000 copies by the summer
- Today I present some of the updates since last IPPOG meeting :)



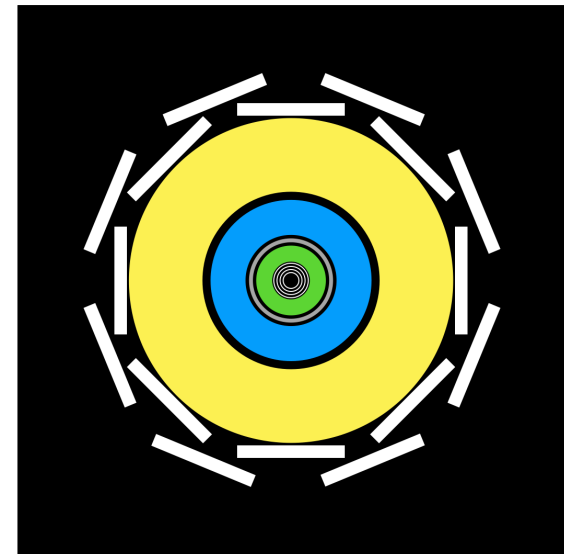
# Some history

- The concept came to me in late 2020 when I first became a father.
- How to *share my passion with my newborn daughter?*
- Communicating particle physics **without using any words at all?**
- **Babies love bold, high-contrast images:** helps them **develop focus and eyesight...** but most books on the market are boring arrays of dots, circles and lines.
- *Oddly familiar to a particle physicist...*



# Some history

- High Energy Physics contains many **striking visuals**, **high-contrast images** and **interesting shapes**:
  - Event displays
  - Feynman diagrams
  - Detector layouts...
- Put two and two together... and **the book was born!**





# Some history

- Created artwork on last day of parental leave, and got a prototype printed on photo-printing website. **My daughter loved it!**

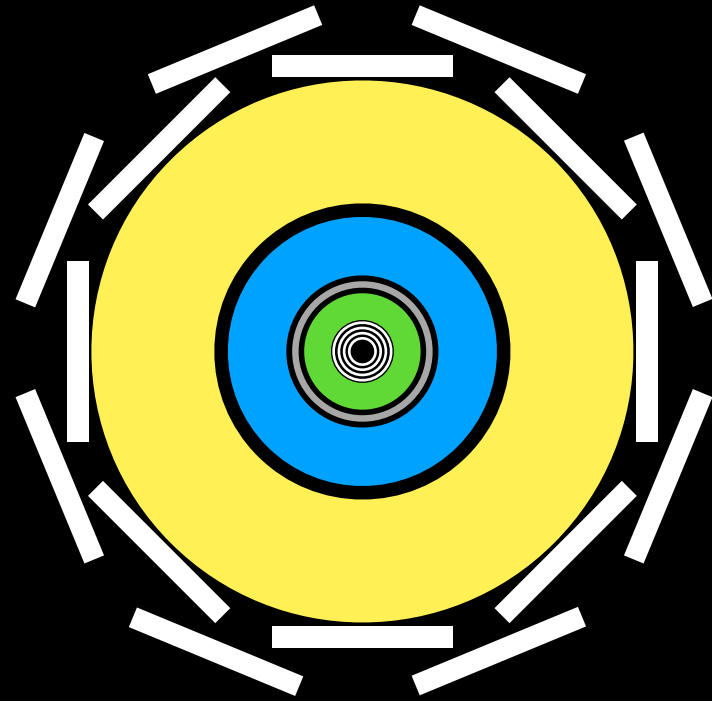


- As more and more friends (physics and non-physics alike) requested copies, I realised the outreach potential of the book. And got in touch with ATLAS Outreach coordinator and IPPOG. That brings us to last November!

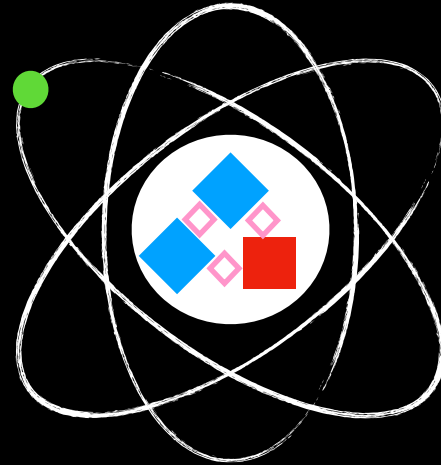
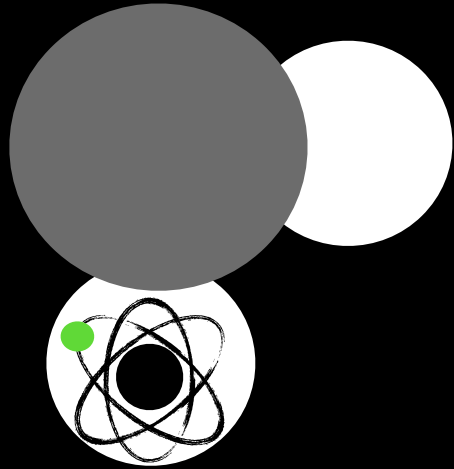
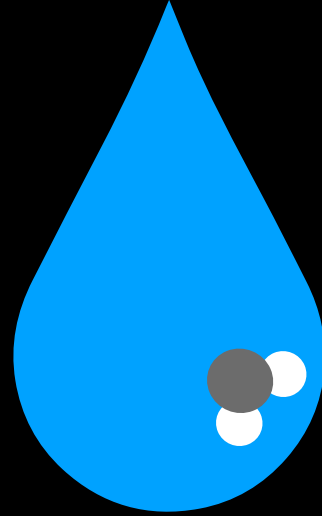
# **The book itself**

## ***A particle physics talk without any words***

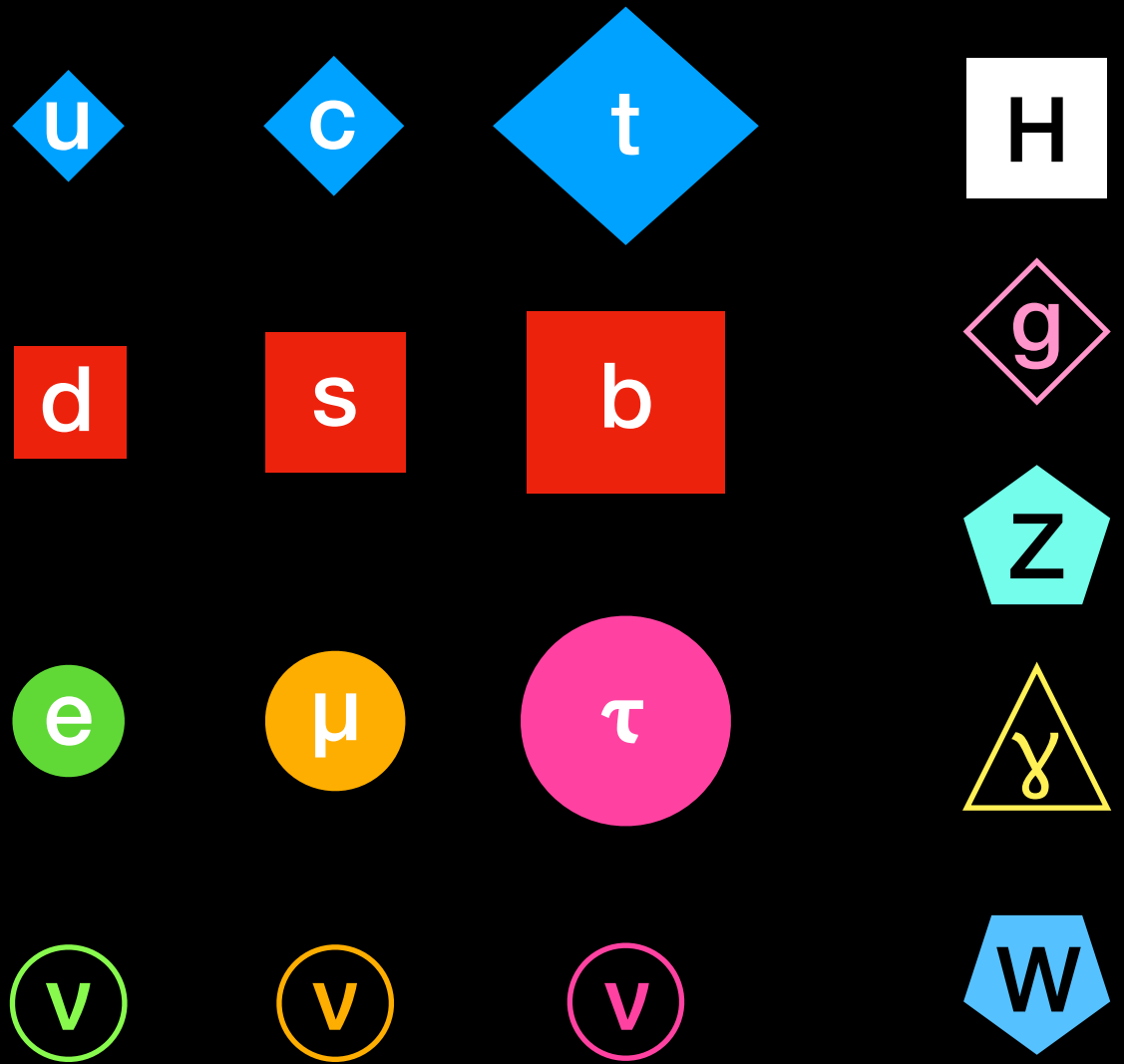
# Particle Physics for Babies

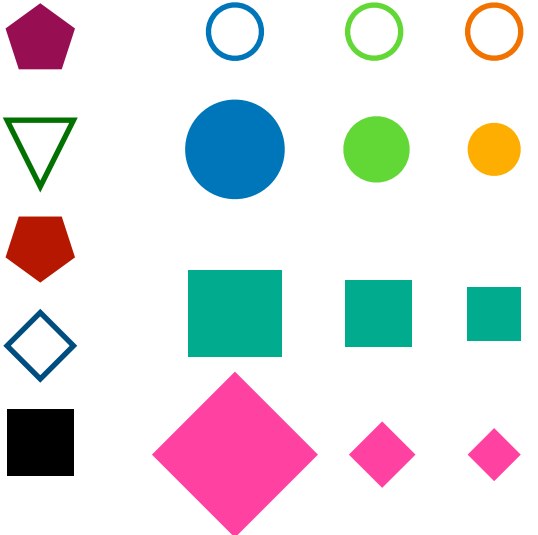
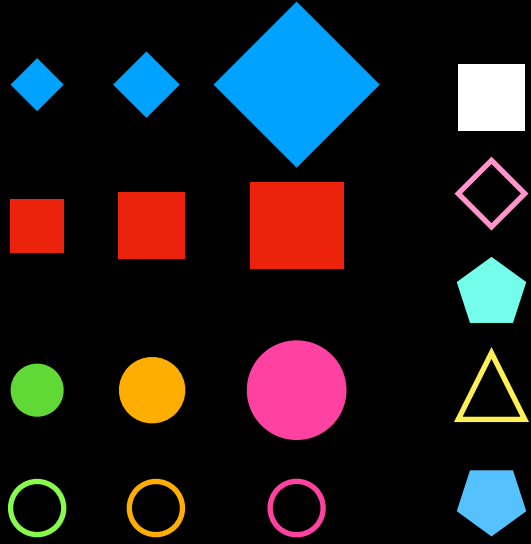


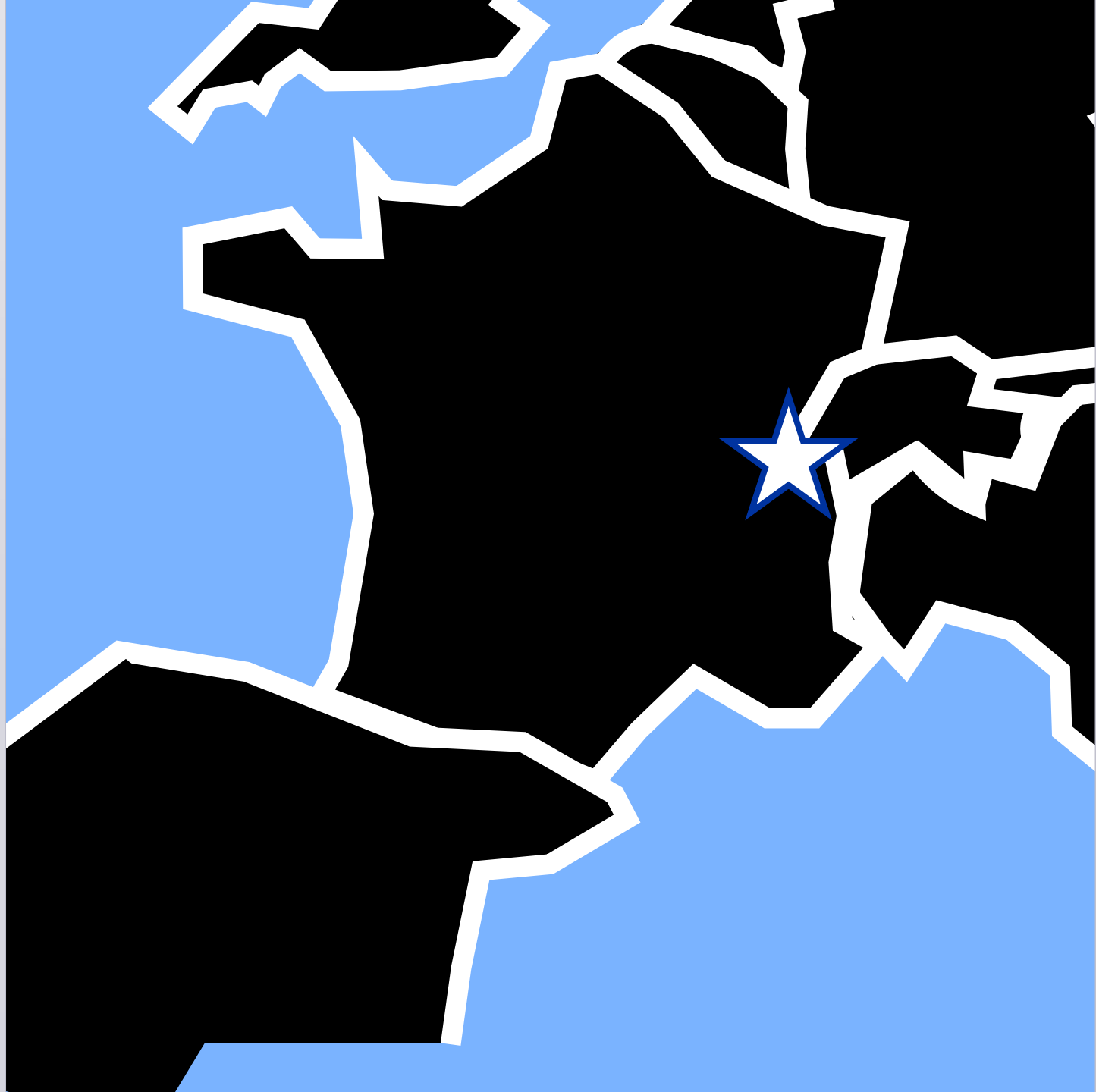
By Dr Louie Corpe

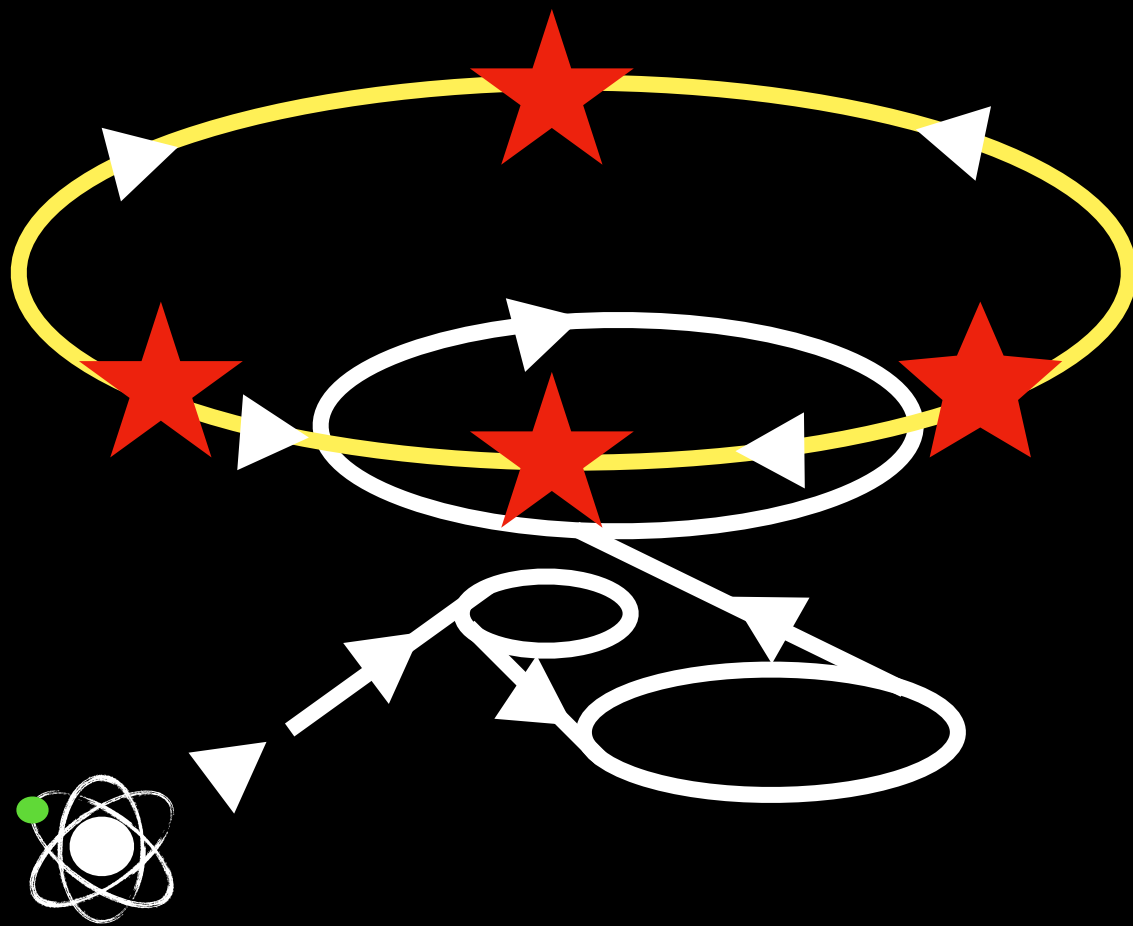


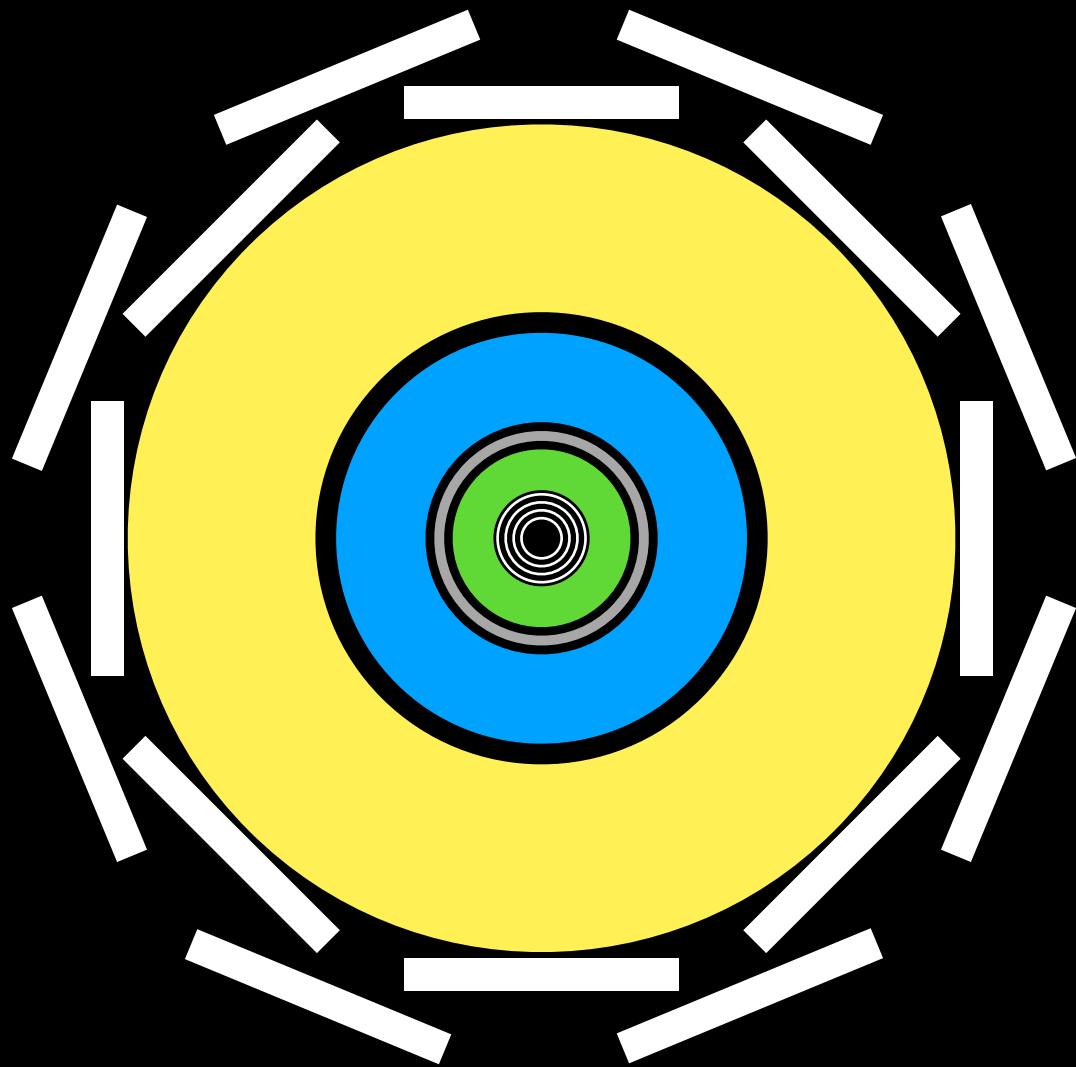


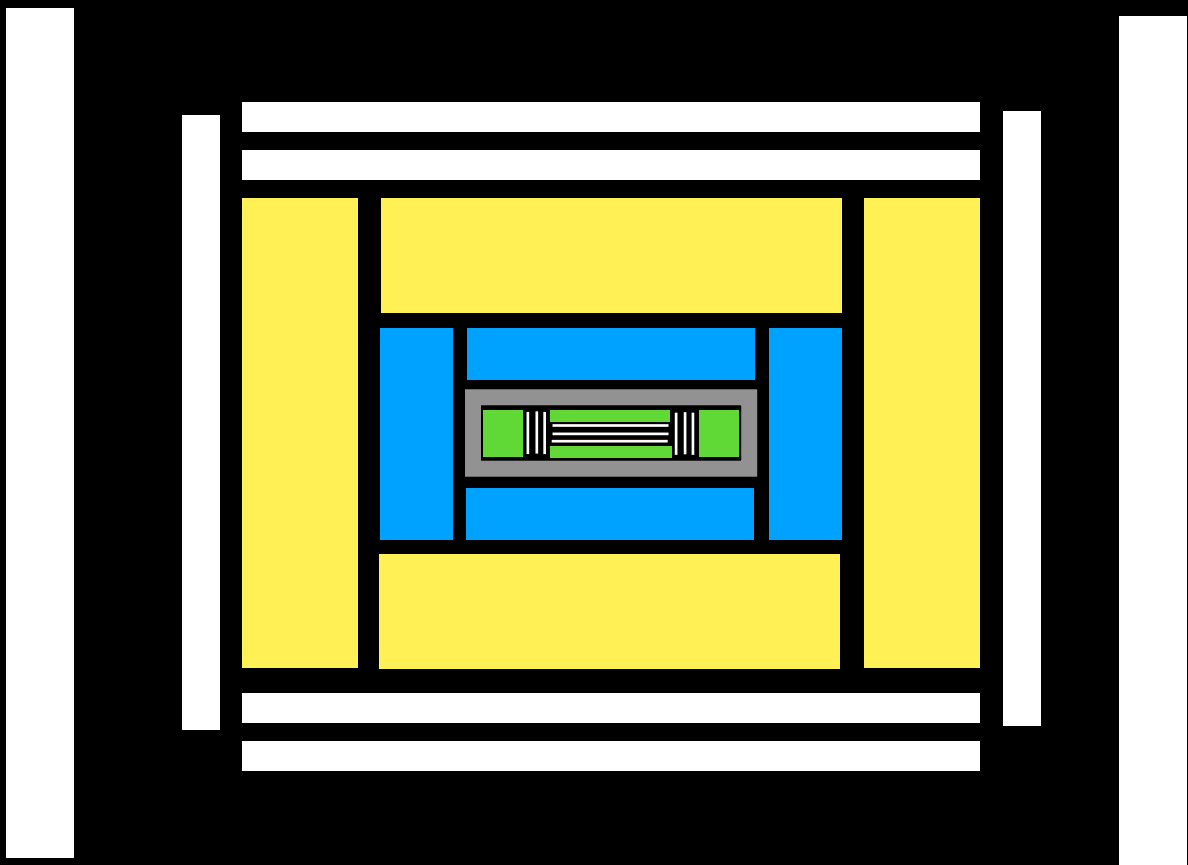




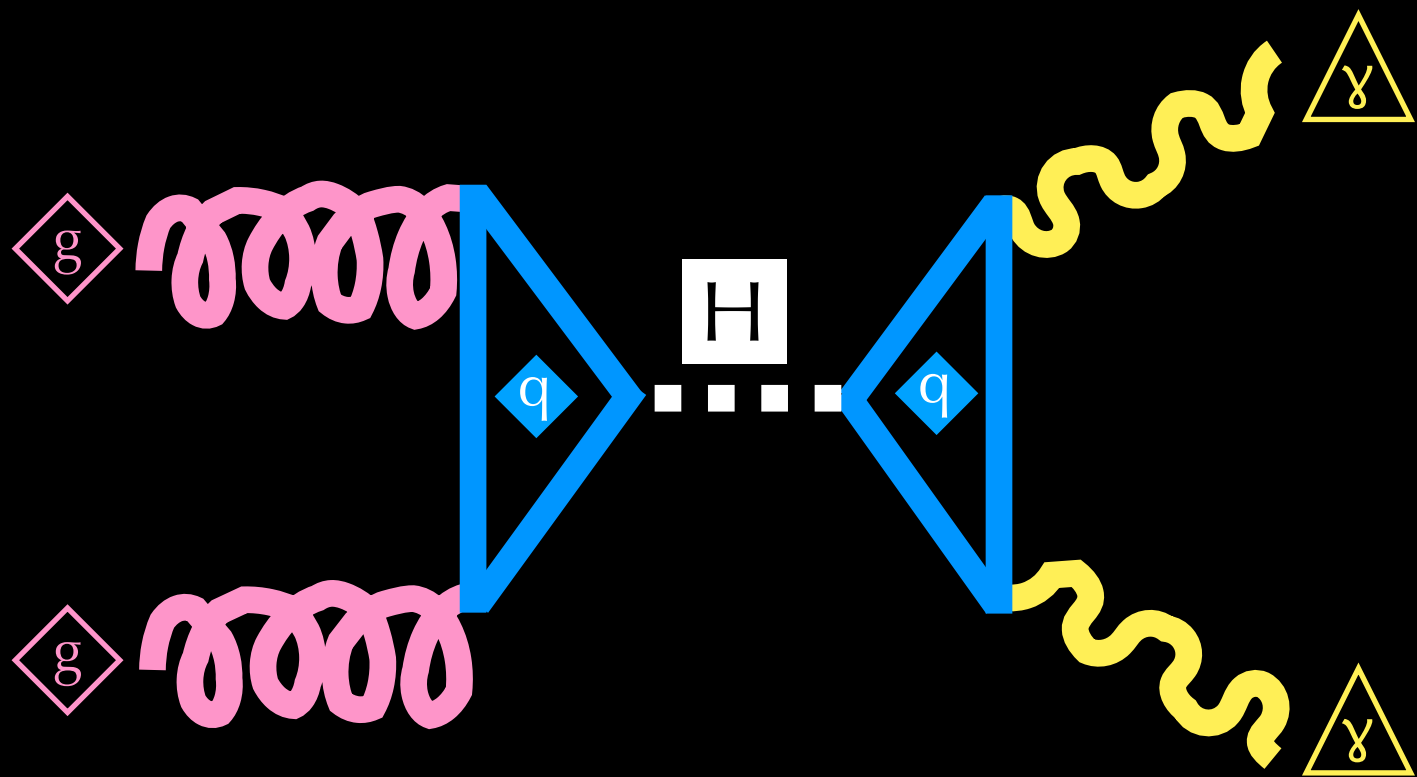


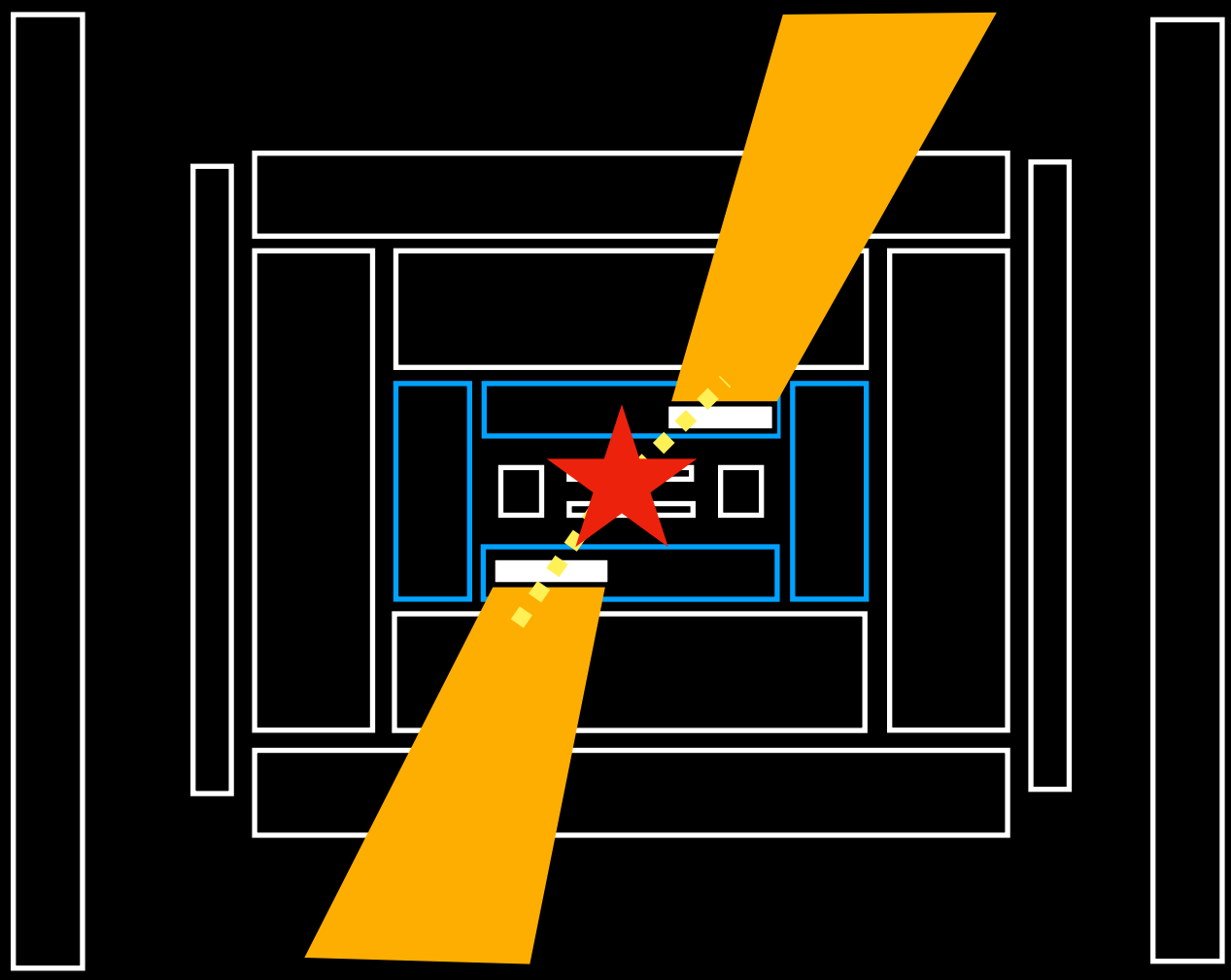


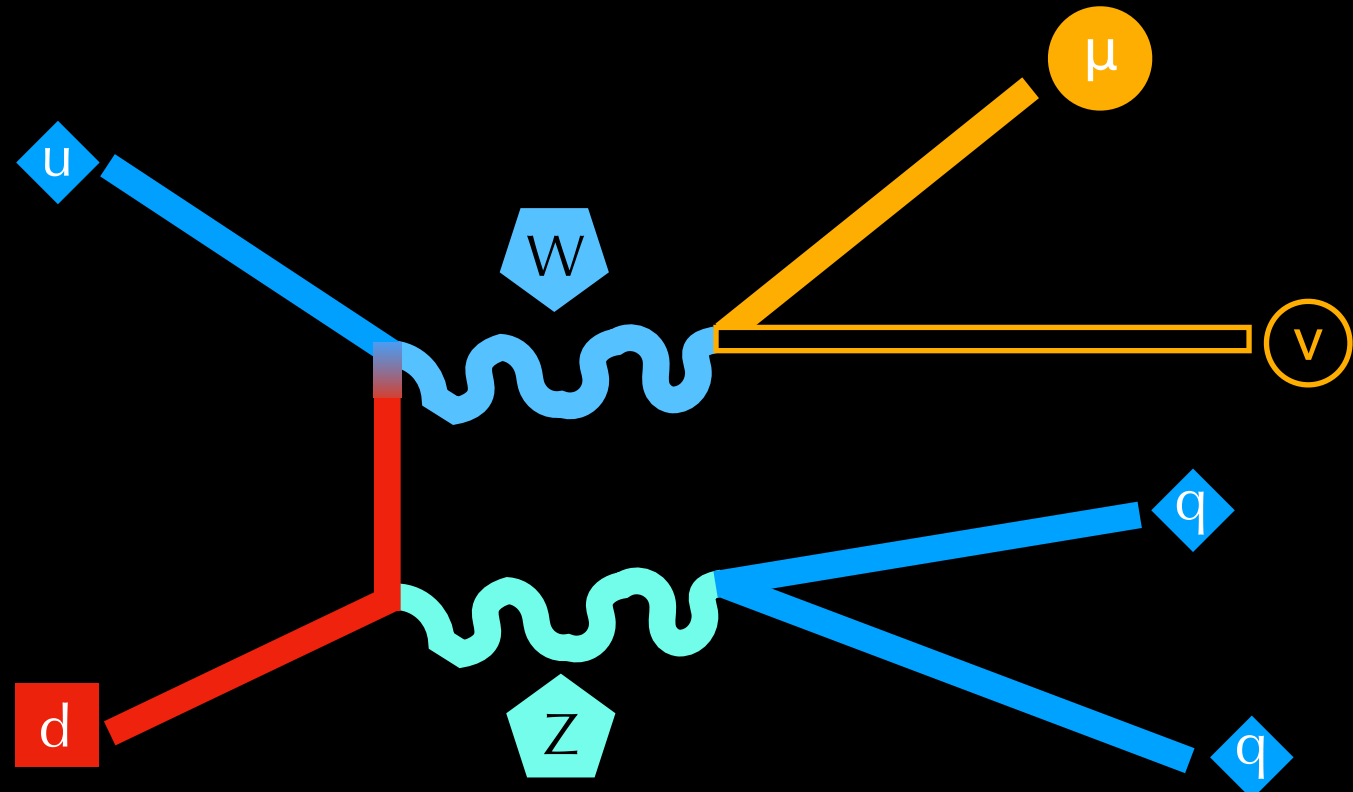


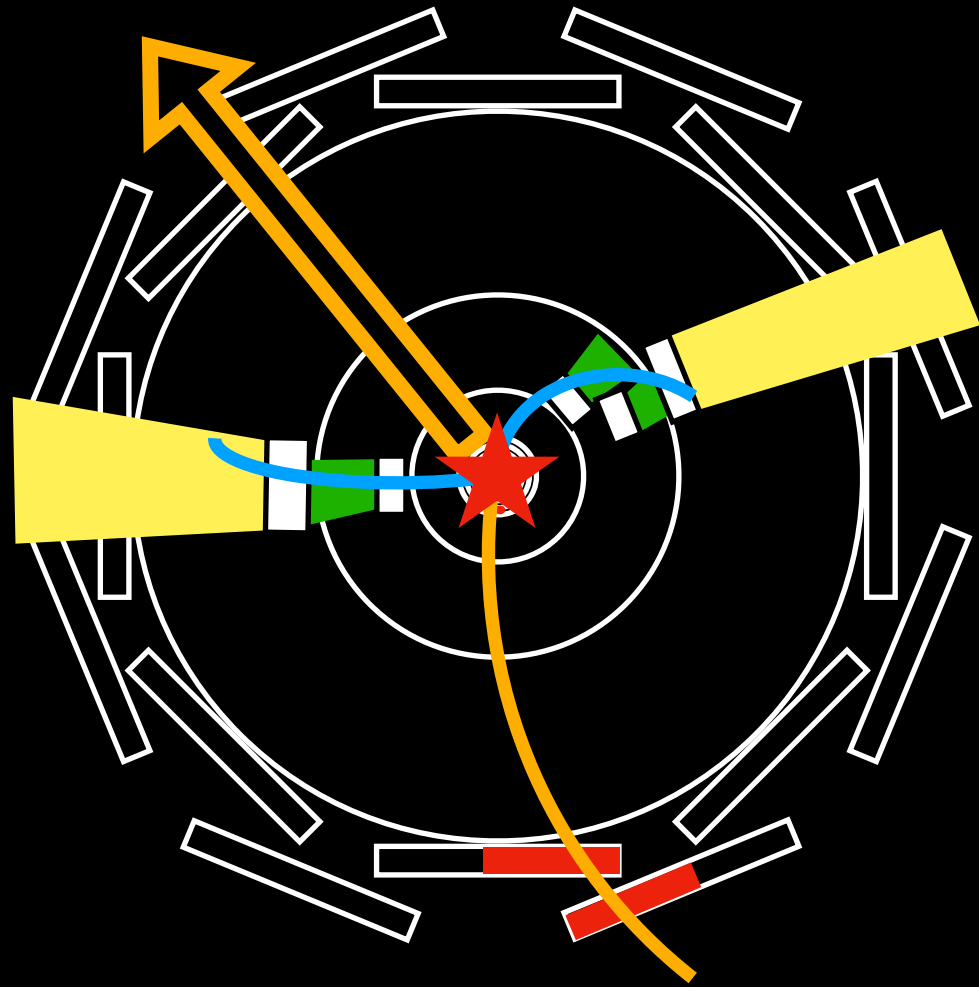


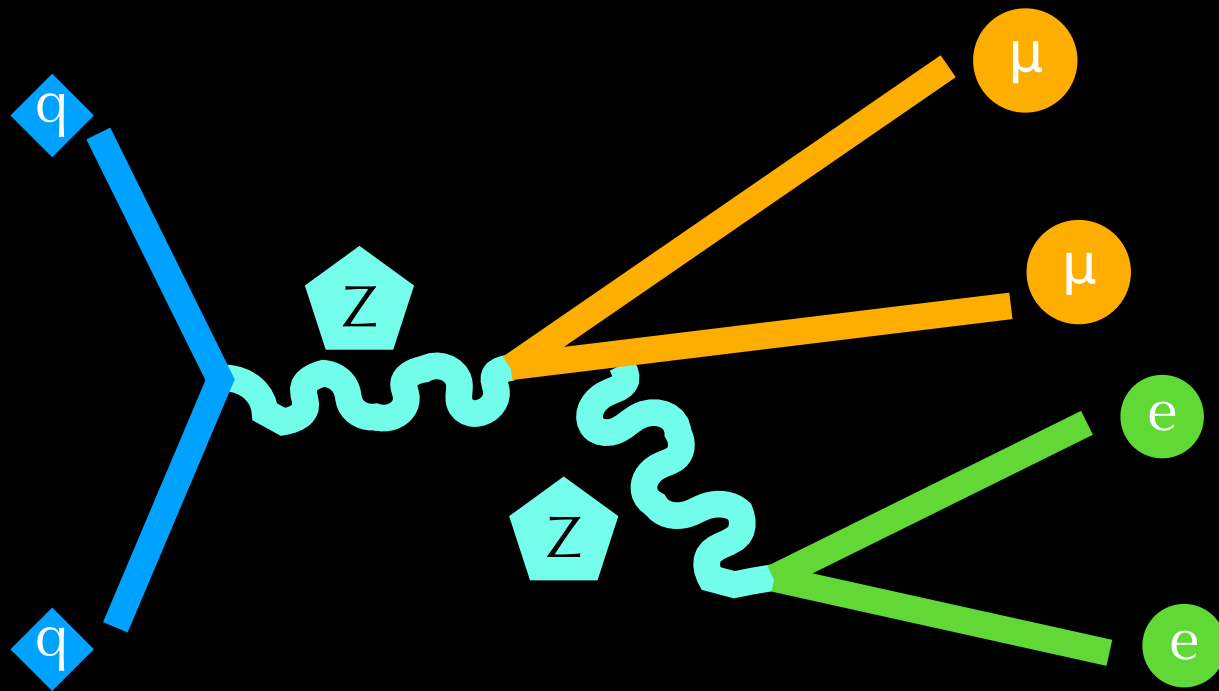


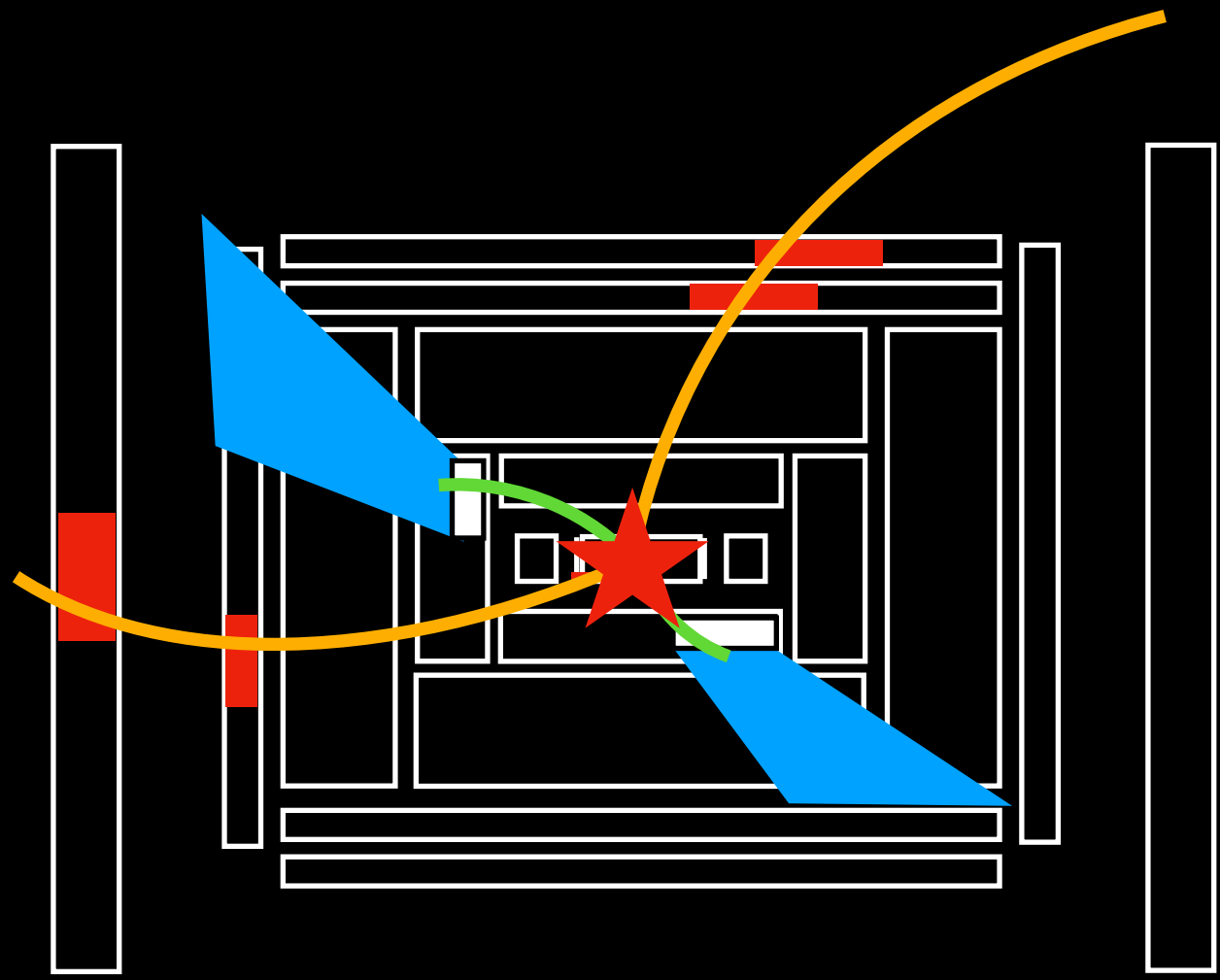




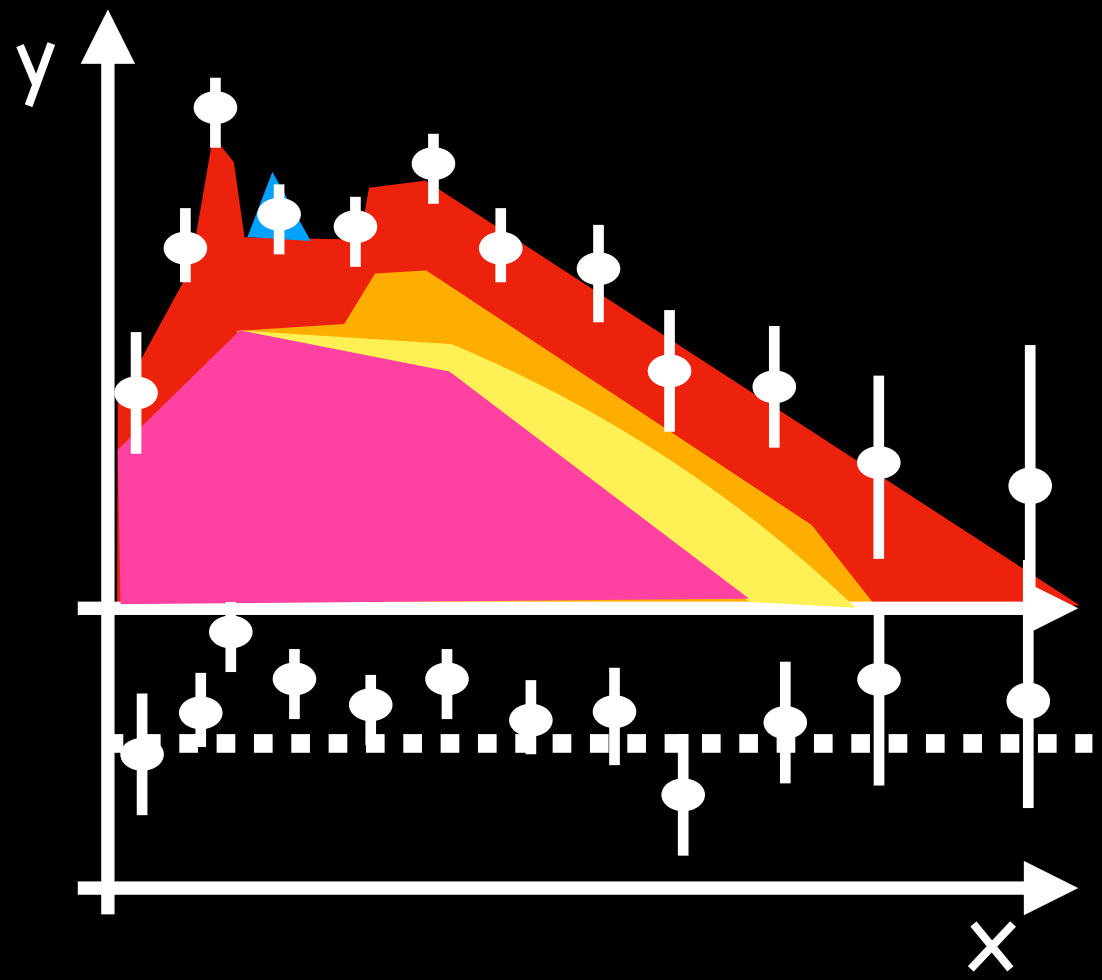


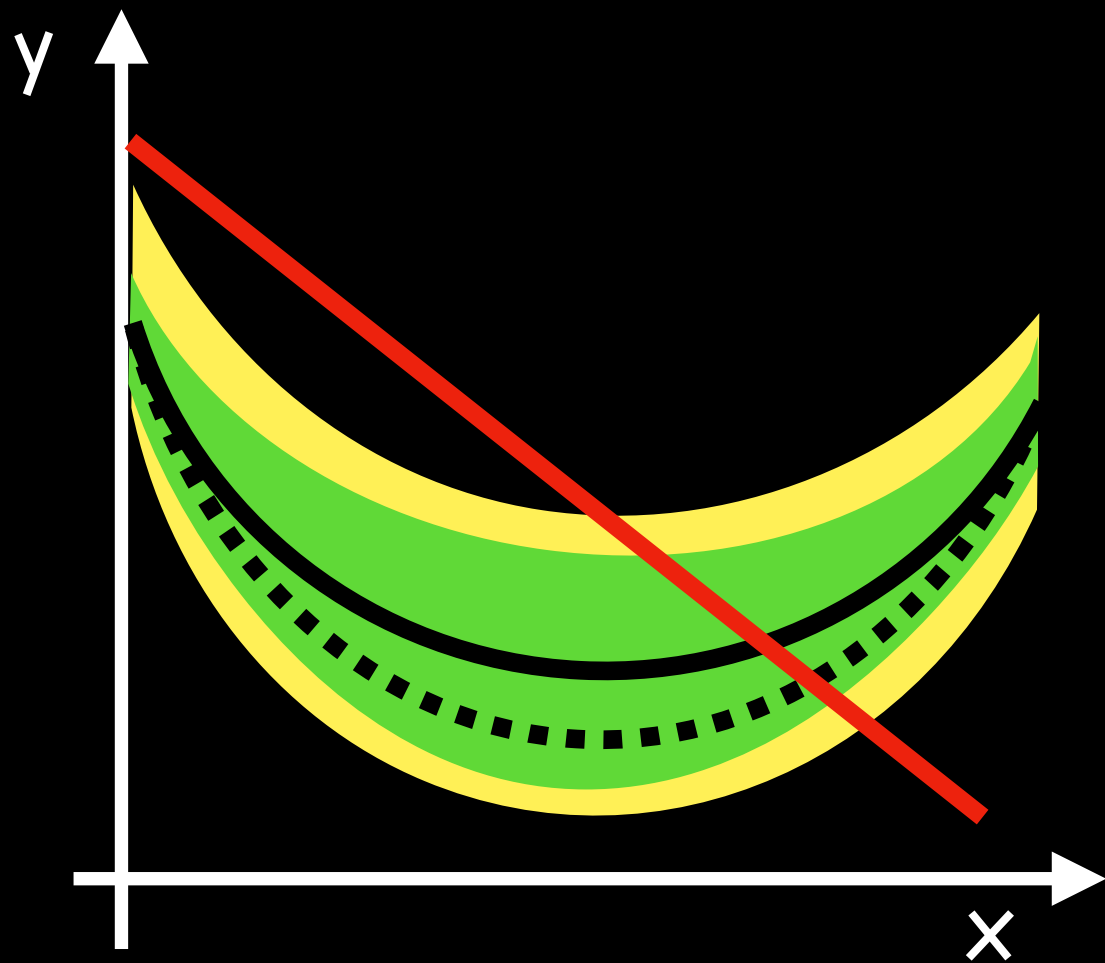


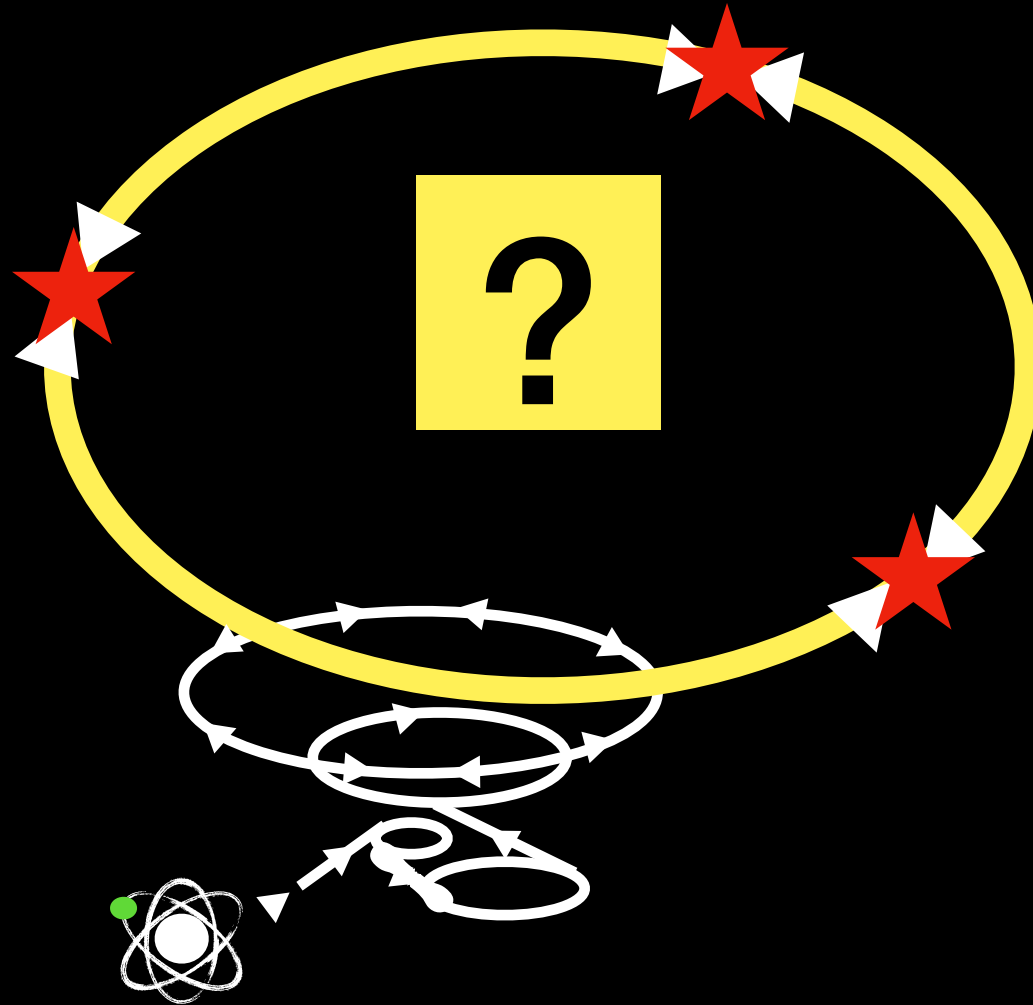












Your Collider ?

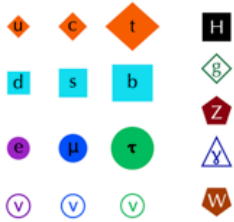
For more information and explanations, visit  
[louiecorpe.com/pp4b](http://louiecorpe.com/pp4b)



Scan  
Me!

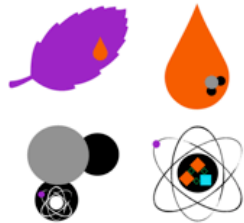
## The Particle Physics Baby Book - Explained !

Page 1



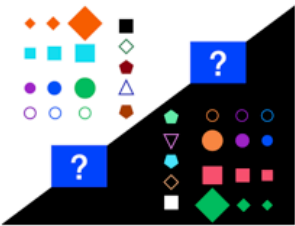
The **Standard Model** is the best guess we have so far of what the building blocks of the Universe are. It contains the **quarks**, the **charged leptons** and their **neutrinos**. The forces which connect these particles are carried by **bosons**, shown in the right-hand column.

Let's journey into the world of particle physics: from a **leaf**, to a drop of **water**, to a **molecule** of H<sub>2</sub>O, and to a **Hydrogen atom**, composed of **quarks** and **gluons** in the nucleus, orbited by an **electron**.



Page 2

Page 3



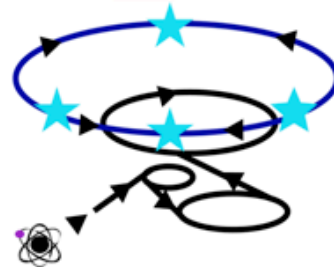
Could there be **more** particles than the ones we know about? **We suspect there are!** We are trying to find them. For example, in a theory called **Supersymmetry**, each Standard Model particle would have a heavier mirror twin.

**CERN** is one of the places where we look for **new particles**. It's on the border between France and Switzerland. It is one of the biggest laboratories in the world!



Page 4

Page 5



Welcome to the **CERN** accelerator complex! **Protons** (Hydrogen nuclei) are accelerated through a series of rings until they reach the **Large Hadron Collider**, moving at nearly at the speed of light. The protons are then **smashed together** so we can see the particles which are produced.

At the collision points, we look for particles with huge detectors, which are like enormous 3D cameras. These pages show cross-sections of the **ATLAS detector**, across (page 6) and along (page 7). From the centre, the **tracking detectors** record trajectories of charged particles like electrons and muons; the **solenoid magnet**

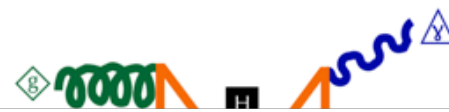


so that the **magnet** bends the trajectories of particles so that we can estimate their momentum; the **electromagnetic calorimeter** picks up electrons and photons; the **hadronic calorimeter** measures the activity from particles made of quarks and gluons; and the **muon spectrometer** tells us where muons passed.

Page 7



This is a Feynman diagram, which shows how an interaction takes place in a

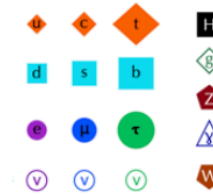


# What is the target audience?

- **Downloadable captions** allow us to reach two audiences for the price of one:
  - **Babies get science as part of their universe from day zero.** Demystify science, part of everyday conversation. Addresses them directly as the scientists of tomorrow
  - **The parents, friends and family, who learn about the LHC while reading them the captions!**
    - The best way to learn something is to explain it to someone else!
- Almost everybody knows *somebody* who is expecting a baby, and it makes for a **unique and quirky present!**

## The Particle Physics Baby Book - Explained !

Page 1



The **Standard Model** is the best guess we have so far of what the building blocks of the Universe are. It contains the **quarks**, the **charged leptons** and their **neutrinos**. The forces which connect these particles are carried by **bosons** shown in the right-hand column.

Let's journey into the world of particle physics: from a **leaf**, to a drop of **water**, to a **molecule of H<sub>2</sub>O**, and to a **Hydrogen atom**, composed of **quarks** and **gluons** in the nucleus, orbited by an **electron**.



Page 2

Page 3



Could there be **more** particles than the ones we know about? **We suspect there are!** We are trying to find them. For example, in a theory called **Supersymmetry**, each Standard Model particle would have a heavier mirror twin.

**CERN** is one of the places where we look for **new particles**. It's on the border between France and Switzerland. It is one of the biggest laboratories in the world!



Page 4



# Why is this urgent?

Print subscriptions

Search jobs

Sign in

Search

International edition

The  
Guardian  
News website of the year

## Education

### Girls shun physics A-level as they dislike 'hard maths', says social mobility head

Female physicists question 'terrifying' claims made by government commissioner Katharine Birbalsingh to MPs

Hannah Devlin Science correspondent and Aubrey Allegretti

Wed 27 Apr 2022 15.30 BST



Researchers found teacher-student relationships played a big role in A-level choices and that gender stereotyping continued to be an issue. Photograph: Mike Goldwater/Alamy

Girls do not choose physics A-level because they dislike "hard maths", the government's social mobility commissioner has claimed, prompting anger from leading scientists.

This is why I believe that :

- having science as part of the conversation from day 0
- addressing kids directly to demystify science ...are essential tasks!

## Physics

### No, girls are not put off by 'hard maths', Katharine Birbalsingh

#### Letters

Thu 28 Apr 2022 17.41 BST



In response to the social mobility commissioner's claim that girls are shunning physics because of its difficulty, **Matthew Belmonte** says we must make Stem classrooms welcoming places for all. Plus letters from **Ruth Rising** and **Rachel Clark**



'I went to a comprehensive school and we were encouraged to do subjects we enjoyed.' Photograph: Martin Godwin/The Guardian

# What's new since November?

- Communication with copyright experts. Book will be released under CC BY-NC-SA 4.0 license.
- Advice from other IPPOG experts, eg CE /UKCA certification logos **Thanks IPPOG!**
- Communication with CERN library: registered for ISBN **Thanks IPPOG!**
- Communication with CERN Store: Have agreed to stock copies! **Thanks IPPOG!**
- Project co-funded by IPPOG/ATLAS **Thanks IPPOG!**
- Exposure: abstracts accepted for LHCP (poster) and ICHEP (parallel talk). **Thanks IPPOG!**
- ***ATLAS Outreach and IPPOG support have been critical!***

Thanks IPPOG!

Back page!

*Grow your own genius with your baby's first foray into the colourful and intriguing world of particle physics. Watch them discover quarks, leptons and bosons, the Large Hadron Collider, particle detectors and collisions at the speed of light. The book comes with downloadable captions and a handy QR code so you can share the secrets of the universe with authority.*

Developed and produced with the kind support of ATLAS and IPPOG



*Original illustrations by  
Louie Corpe © 2022  
Released under a  
Creative Commons  
BY-NC-SA 4.0 license*

*To Nora, thank you for being the  
inspiration for this book.*



# The economics of baby books

- IPPOG/ATLAS funding -> CERN procurement service.
- Not many European printers of board books, but have located companies who can do it for us
- Global paper shortage (!) and other bumps along the road: will not deter us!
- The economics of the book are sound:
  - Unit manufacture price : around 3-5 CHF.
  - Proposed retail price : around 12 CHF (in line with conventional children's books, proposed by CERN store)

First 1000 copies expected over the summer.

Stocked at CERN store, ATLAS secretariat, IPPOG events and my website.

ATLAS Outreach and IPPOG will very quickly recoup their investment, profits can be redirected to other outreach projects.

# Spreading the word

- Particle Physics for Babies will feature at:
  - LHCP (poster session)
  - ICHEP (parallel talk)
- Thanks to the IPPOG team for suggesting the abstract submission.
  - QR code landing page contains sign-up list so people can express an interest and be notified when books arrive at CERN store.

## Particle Physics for Babies

Outreach for the youngest audience

### What is it?

- I became a father in late 2020. How to share my passion with my newborn daughter? communicate particle physics without using any words at all?
- Babies love bold, high-contrast images: helps them develop focus and eyesight... but most books on the market are boring arrays of dots, circles and lines. Oddly familiar to a particle physicist...
- High Energy Physics contains many striking visuals, high-contrast images and interesting shapes.
- Put two and two together... and the book was born!
- Created artwork on last day of parental leave, and got a prototype printed. My daughter loved it!

### A baby book as an outreach tool ?

- More and more friends requested copies, for physics and non-phycists alike... Realised the potential of the book as an outreach tool.
- Worked with ATLAS Outreach and International Particle Physics Outreach Group (IPPOG)
- Refined concept and artwork, added downloadable captions: non-phycists can describe book to their babies with confidence.

Prototype of the board book  
A fascinated baby!

### A particle physics outreach talk... without any words at all!


### Who is the target audience?

Downloadable captions allow us to reach two audiences for the price of one:

- Babies get science as part of their universe from day zero. Demystify science, part of everyday conversation. Addresses them directly.
- The parents, friends and family, who learn about the LHC while reading them the captions!

Almost everybody knows somebody who is expecting a baby, and it makes for a unique and quirky present!

### Where can I get one?!

- Initial print run kindly funded by ATLAS and IPPOG (+ invaluable advice, support and encouragement!)
- CERN gift store have pre-ordered copies. It will also be stocked at ATLAS secretariat and [louiecorpe.com](http://louiecorpe.com) (where you can pre-order a copy.)
- First copies expected over the summer. Expected price ~12 CHF. PDF+captions downloadable free. Creative Commons BY-NC-SA License

Your Collider ?  
Scan me for captions!

Louie Corpe (CERN). LHCP conference 2022, Taipei/Online (2022)

# In summary

- A sleep-deprived idea has ballooned into an incredible project, thanks to the help and support of IPPOG and the ATLAS Outreach coordinators
- The book has real outreach potential, hits multiple target audiences
- First copies expected over the summer and stocked in CERN Store, amongst other places.
- Spreading the word at the summer conferences.
- Thanks again to the IPPOG community without whom we could not have come this far!