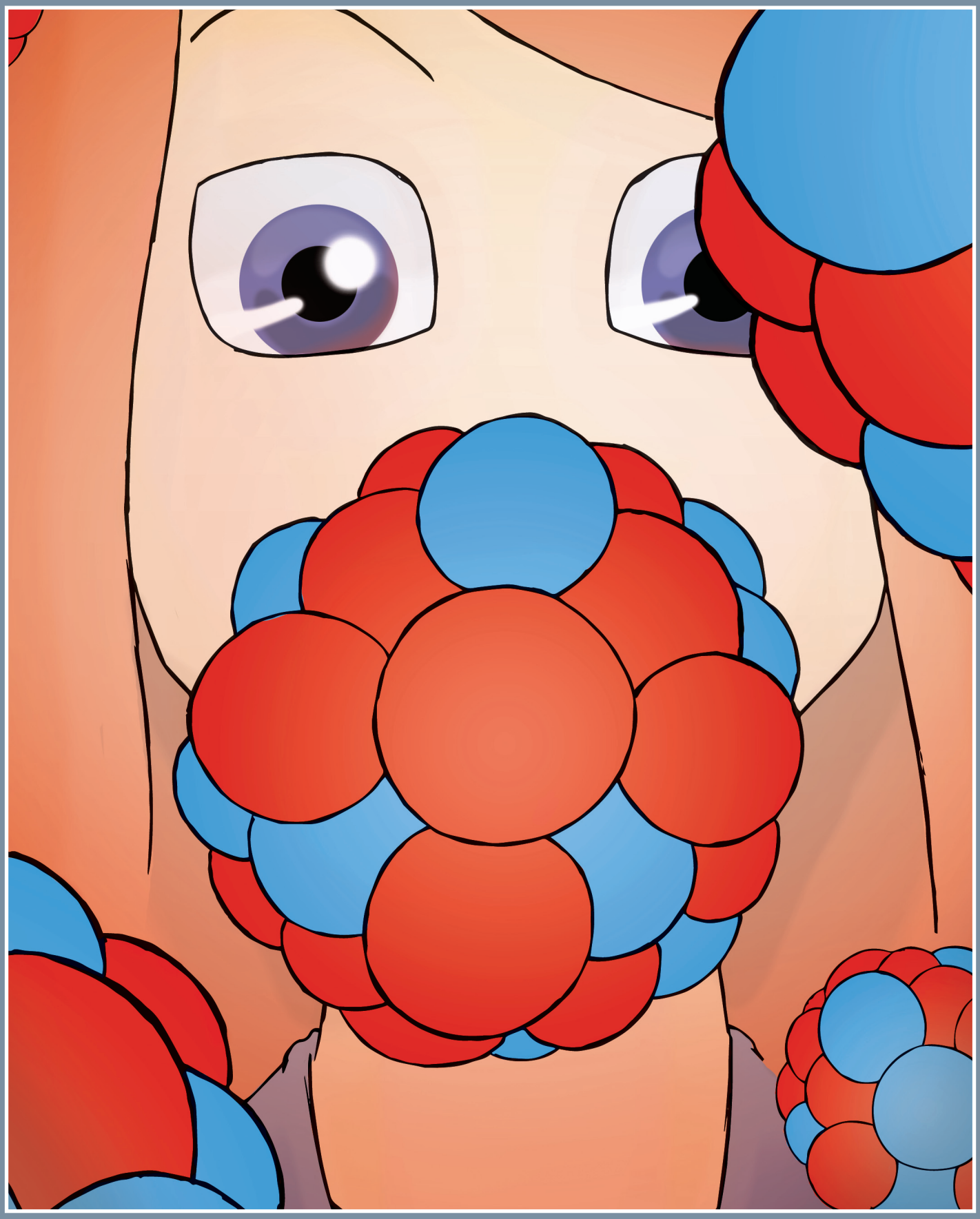
# A L I C E



# ALICE : A Large Ion Collider Experiment

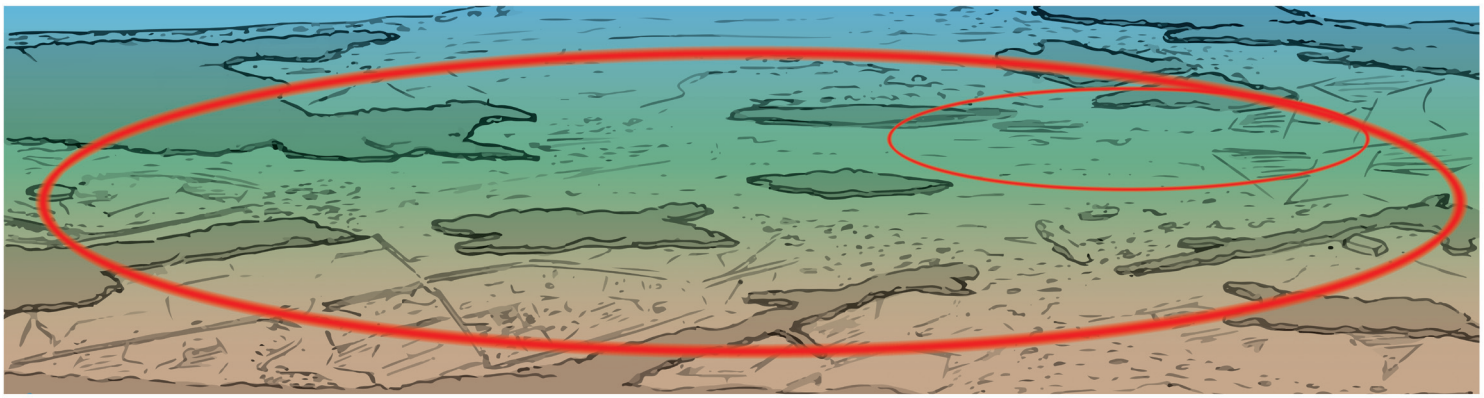
**Cartoonist:** Mehdi Abdi for the 2014 Edition

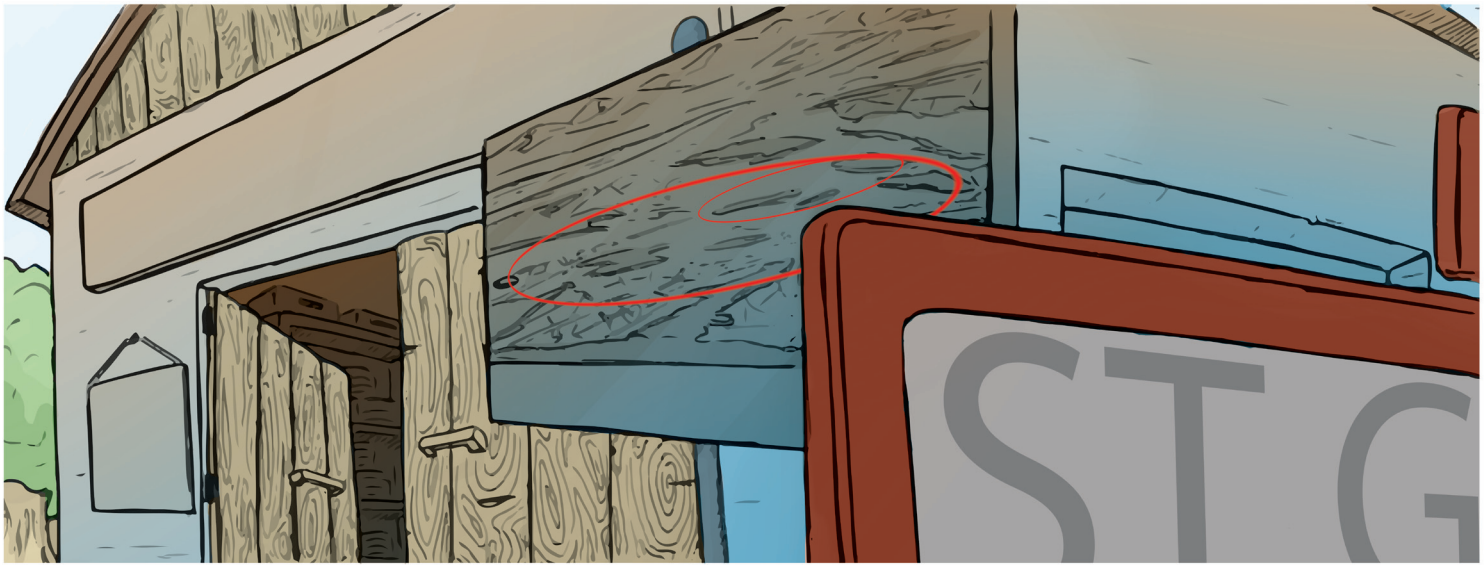
**Scenario and text:** Federico Antinori, Panagiotis Charitos, Catherine Decosse, Yiota Foka, Hans de Groot, Despina Hatzifotiadou, Yves Schutz and Christine Vanoli

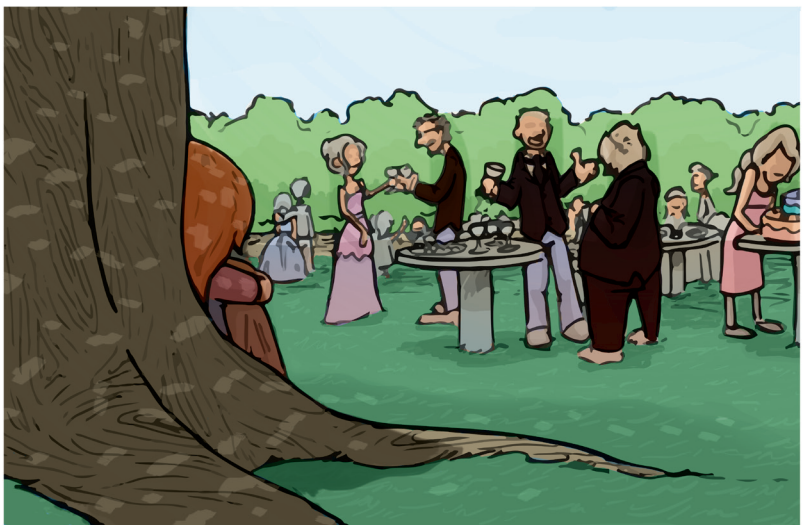
The team wishes to thank Julie Hadre and Fabienne Marcastel

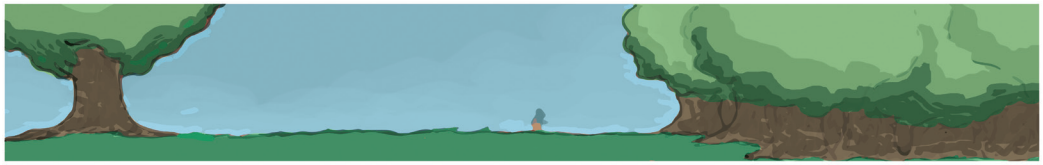
ALICE Experiment
European Organization for Nuclear Research
CH–1211 Geneva 23 – Switzerland
www.cern.ch/ALICE

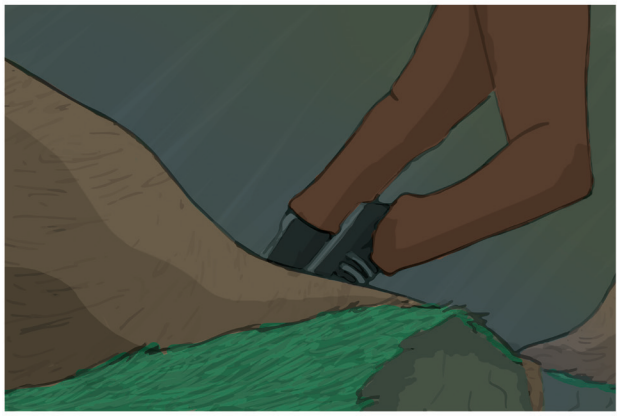
alice.image@cern.ch

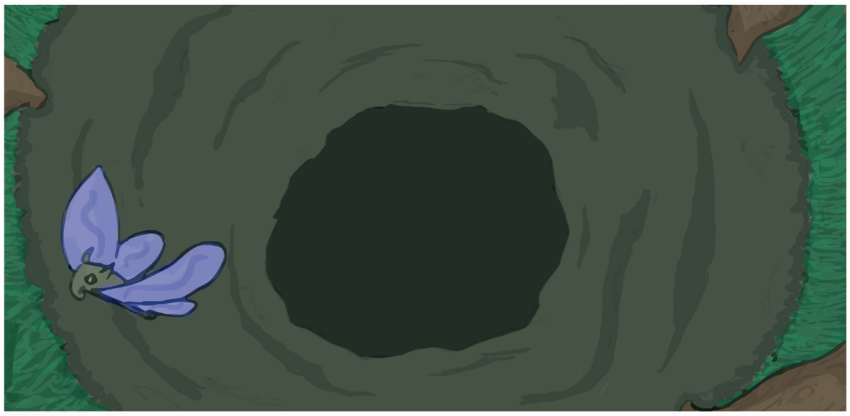


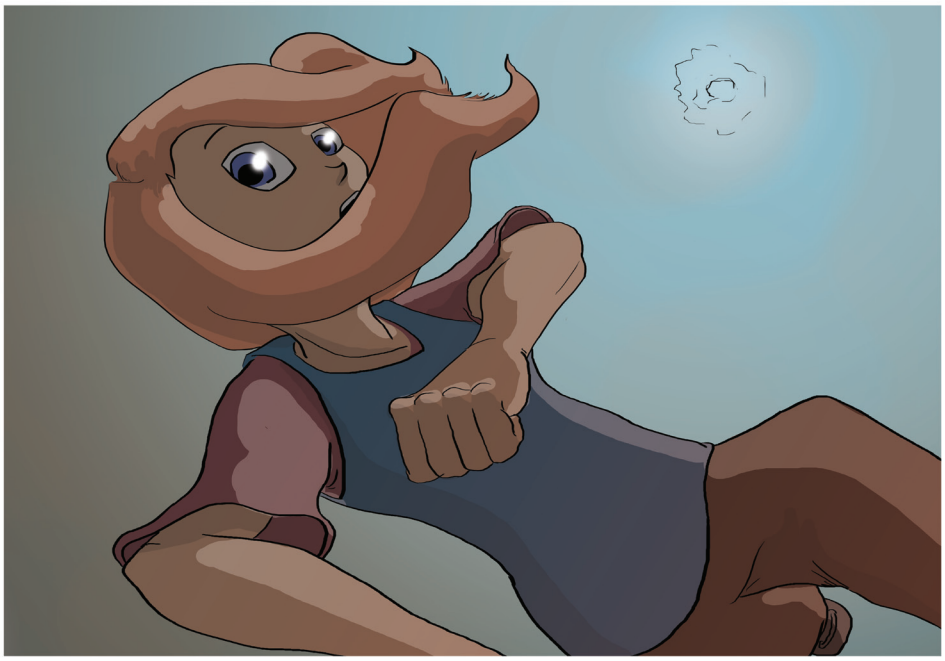


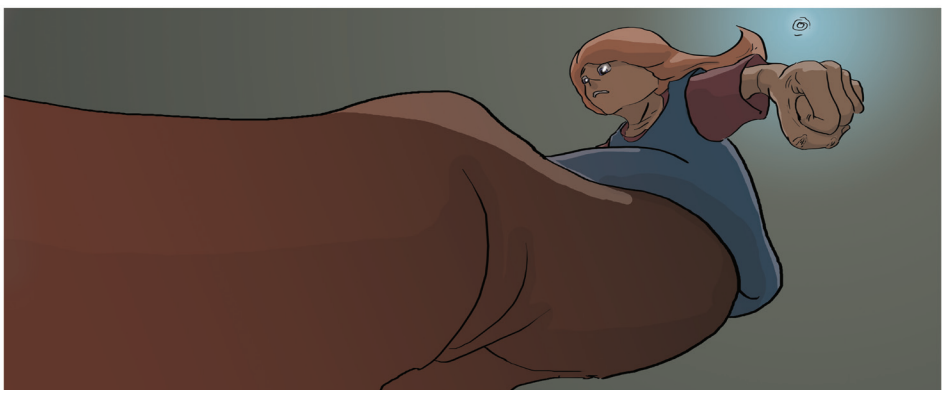


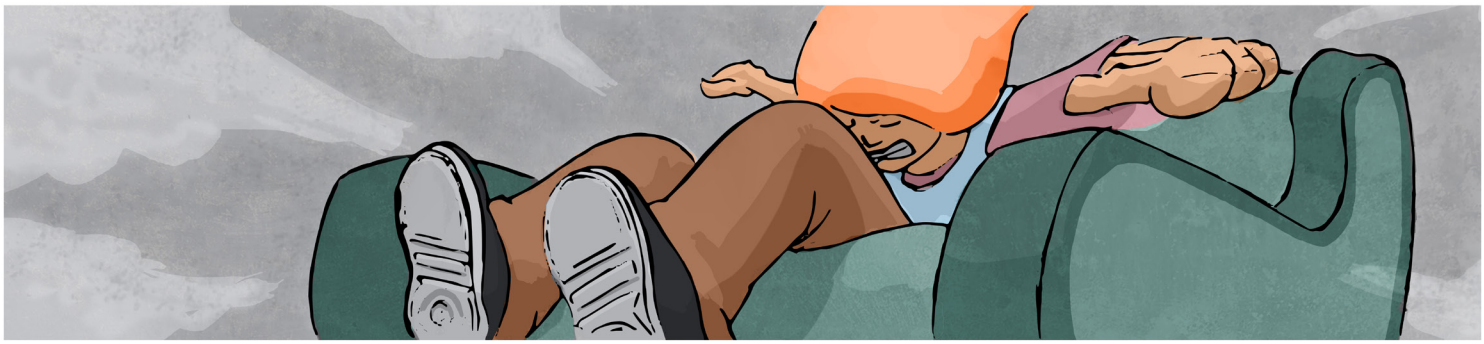













Wow!
What a fall.

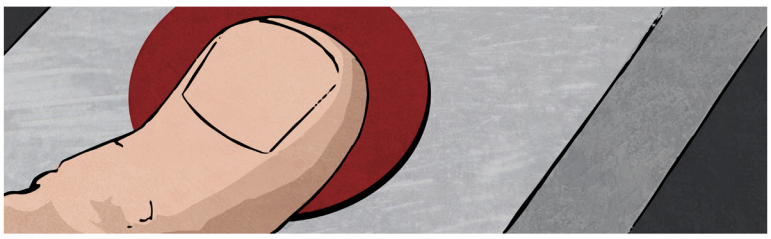

I must be near the centre of the earth...

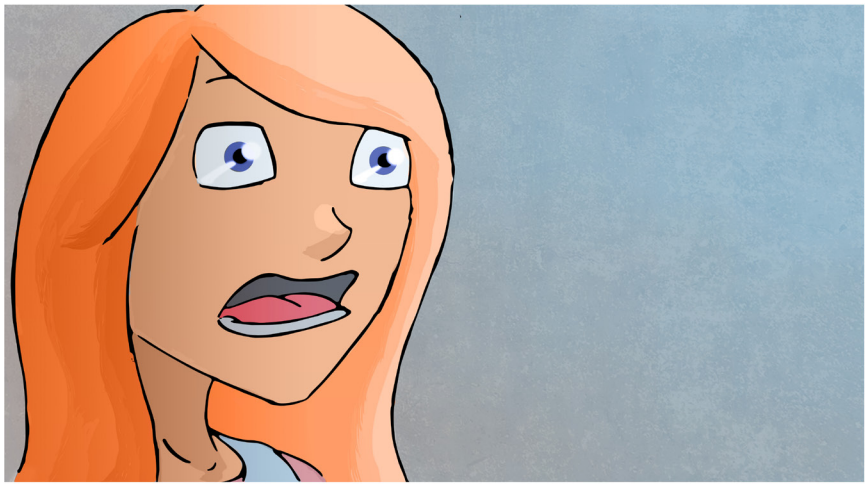

Well, well, you are a curious little girl, aren't you?


You've just fallen 52 metres into the pit of ALICE.

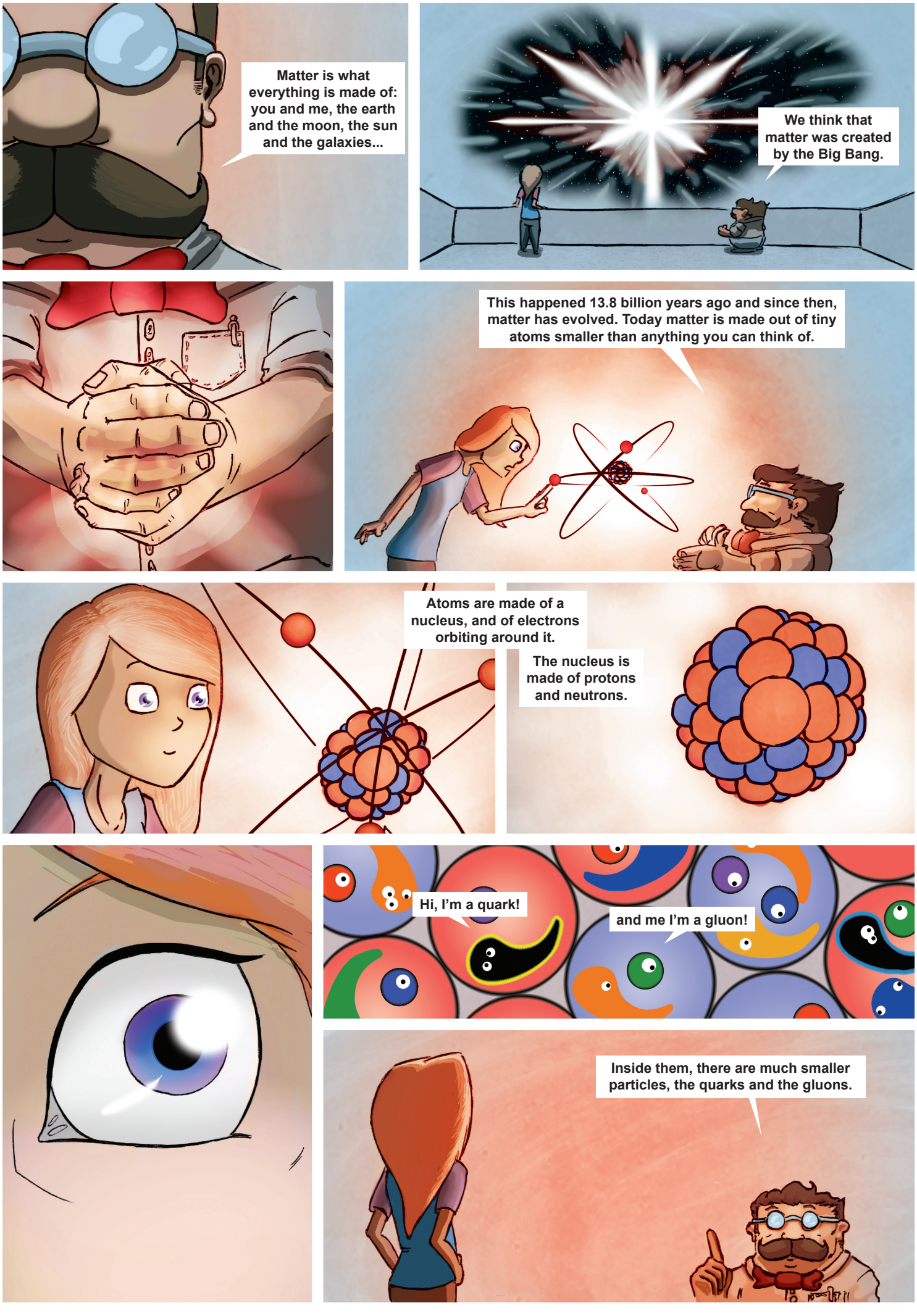

Alice?! My name is Alice too! What's yours?

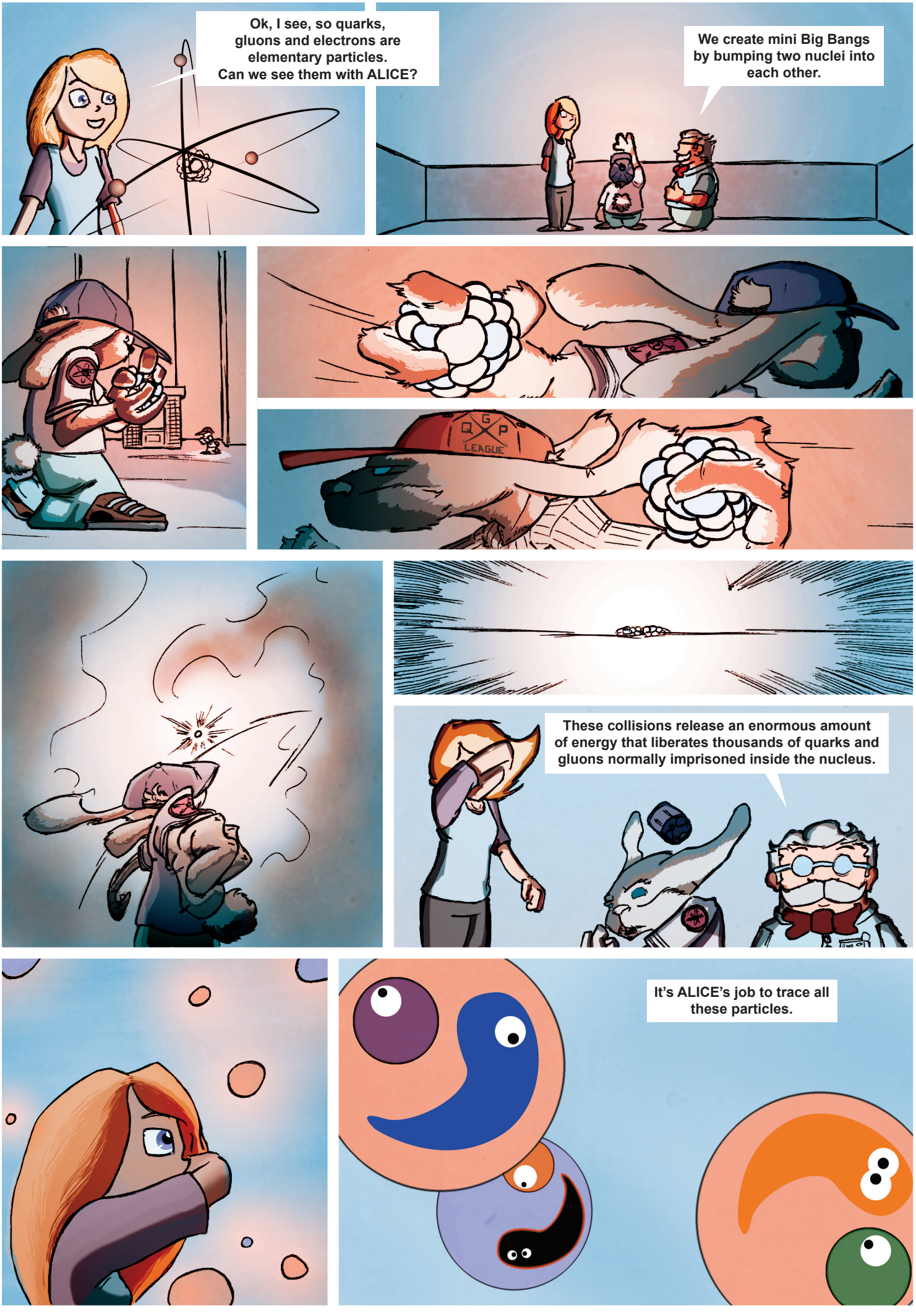

I'm Carlo.
I'm a physicist.

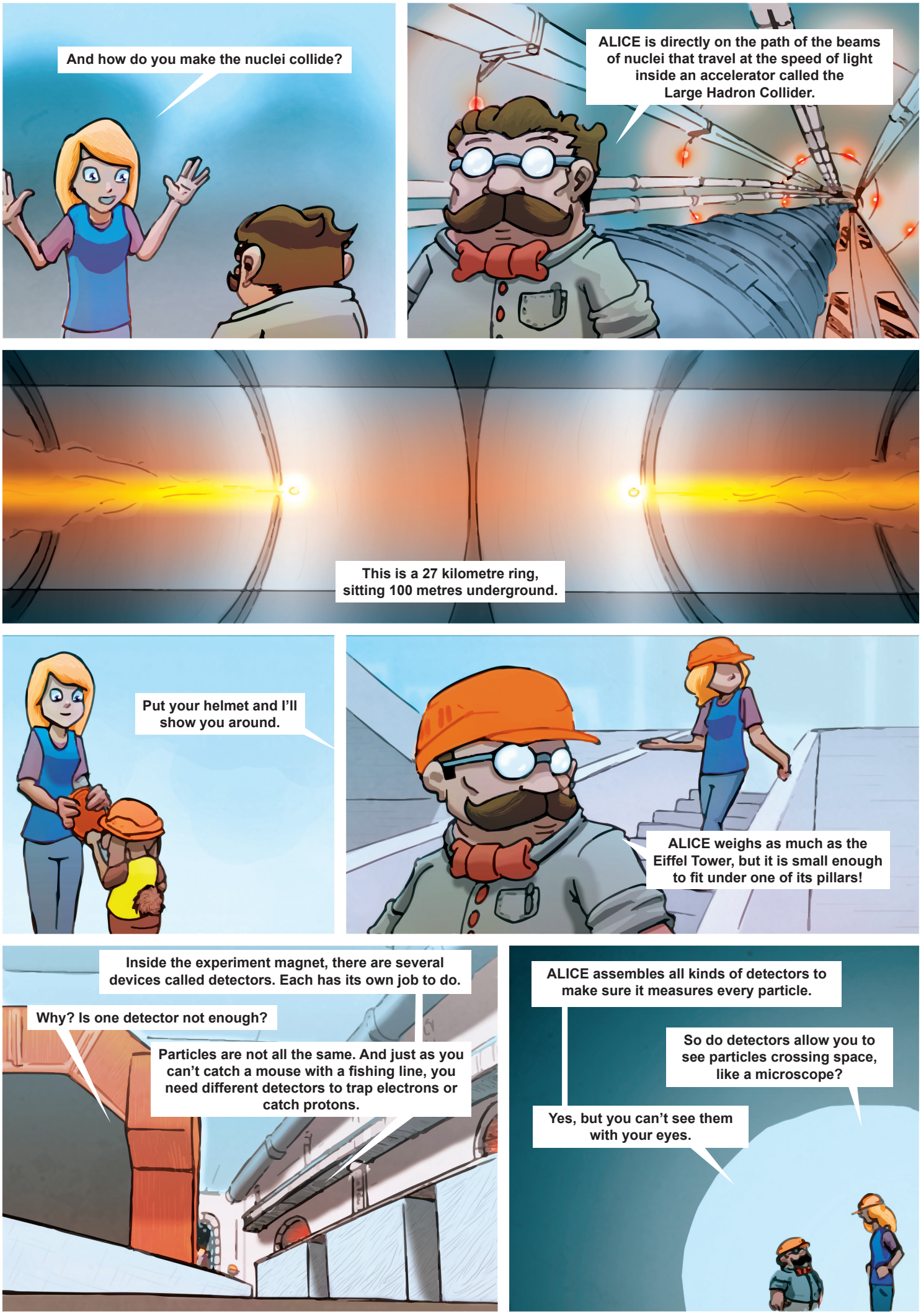


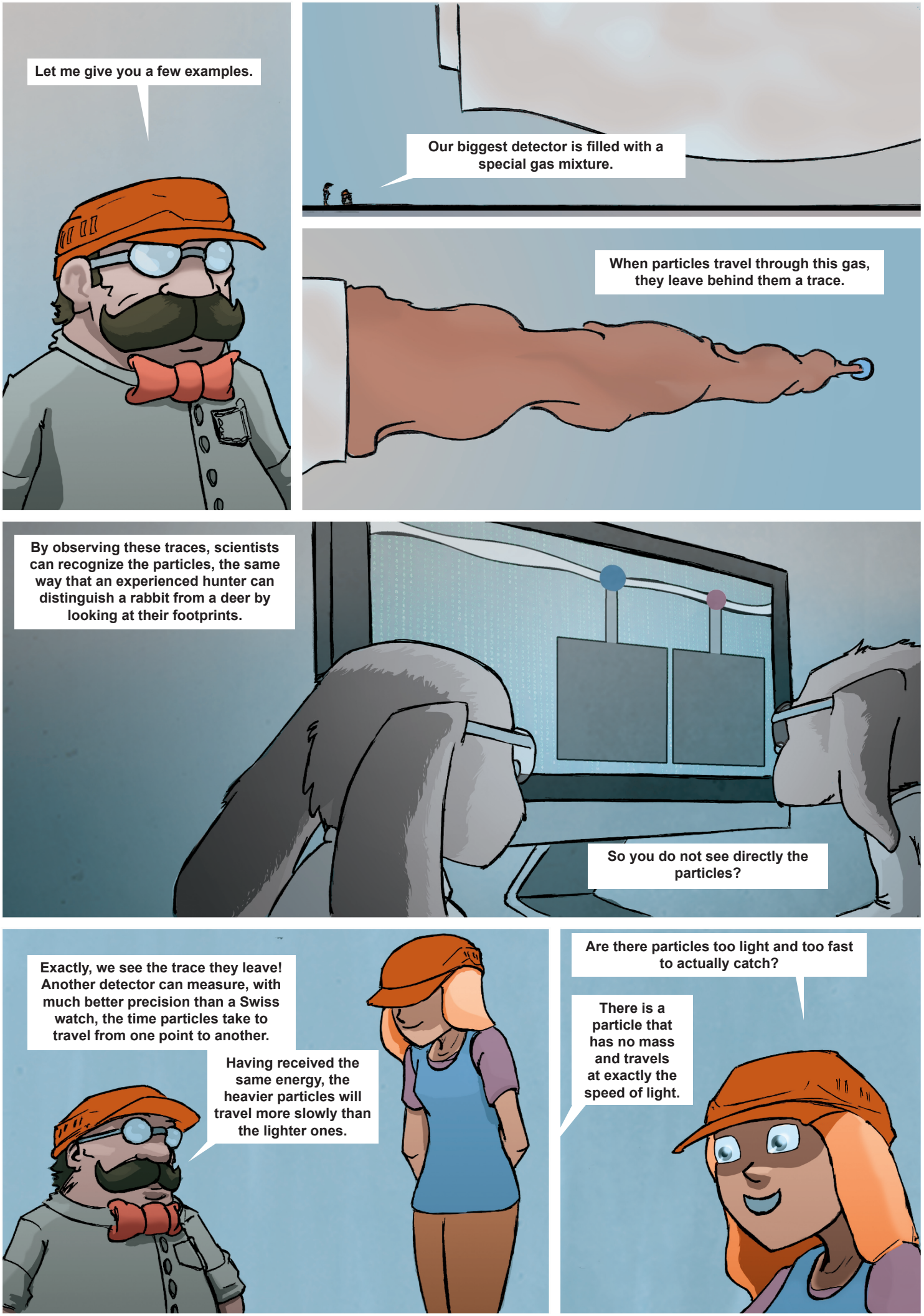


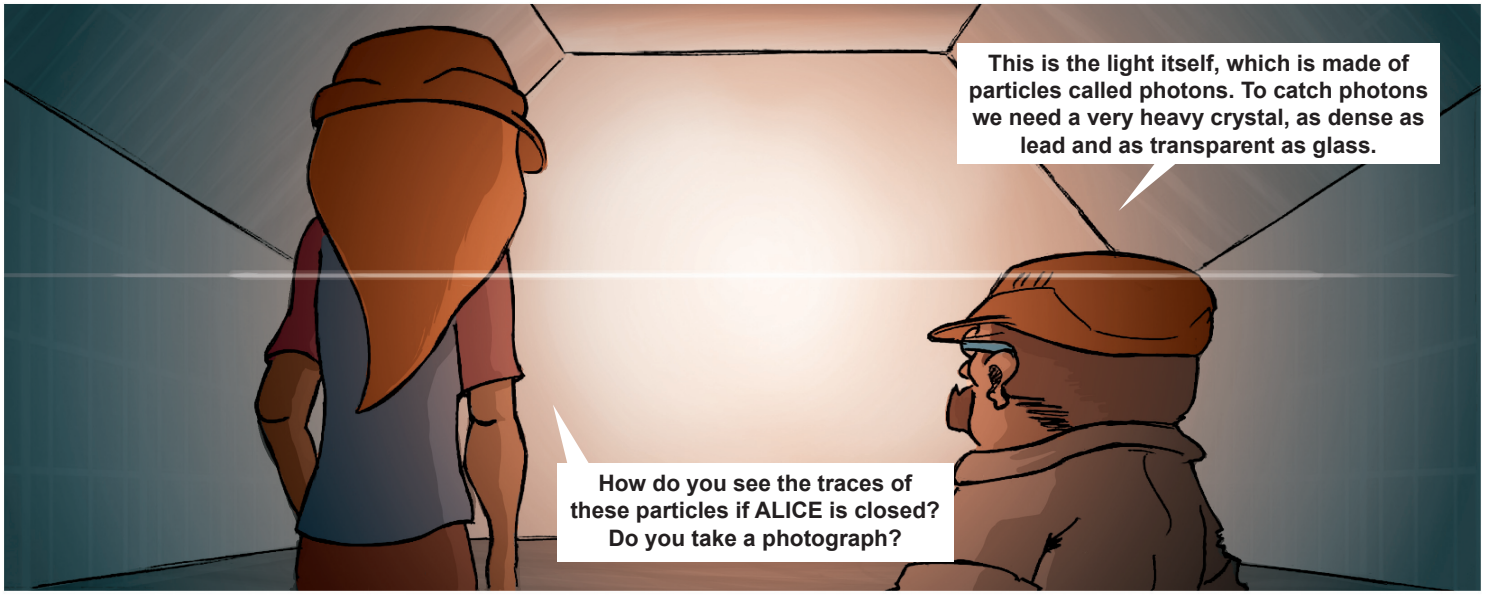

ALICE is one of the four LHC experiments at CERN.
ALICE stands for A Large Ion Collider Experiment and is using the Large Hadron Collider, the biggest accelerator on the earth to collide lead nuclei.
The lead nuclei are accelerated almost at the speed of light, they collide and what is inside them melts. We almost create a tiny droplet of the early universe in our laboratory that lives only a fraction of a second as particles quickly are bound together to form more stable matter.
What are these particles?
Do they look like the one that I was running after?
Did you see it? This was one of the quarks, the building blocks of the matter that everything is made of. These are particles created after the Big Bang.
Big Bang? Matter? Quarks? What do all these names mean? They sound interesting but I don't understand.

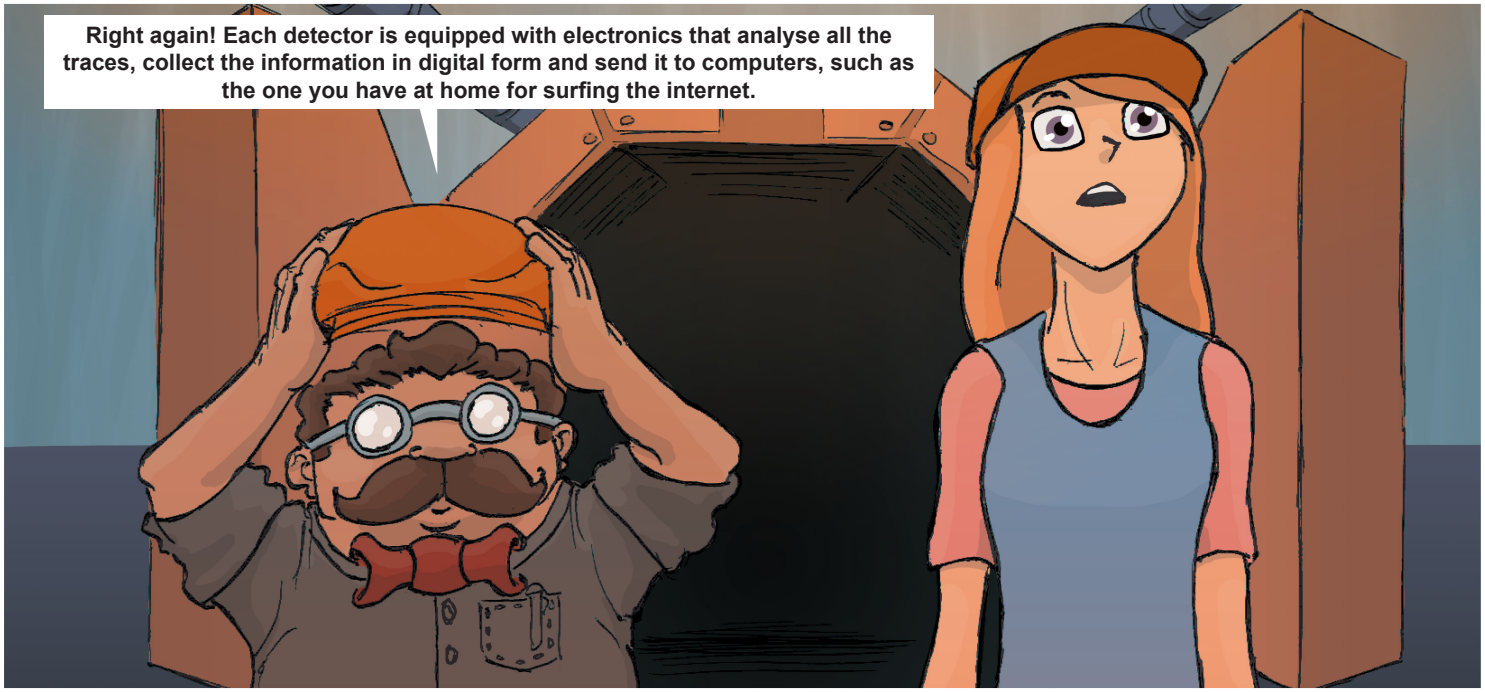

Matter is what everything is made of: you and me, the earth and the moon, the sun and the galaxies...
We think that matter was created by the Big Bang.
This happened 13.8 billion years ago and since then, matter has evolved. Today matter is made out of tiny atoms smaller than anything you can think of.
Atoms are made of a nucleus, and of electrons orbiting around it.
The nucleus is made of protons and neutrons.
Hi, I'm a quark!
and me I'm a gluon!
Inside them, there are much smaller particles, the quarks and the gluons.

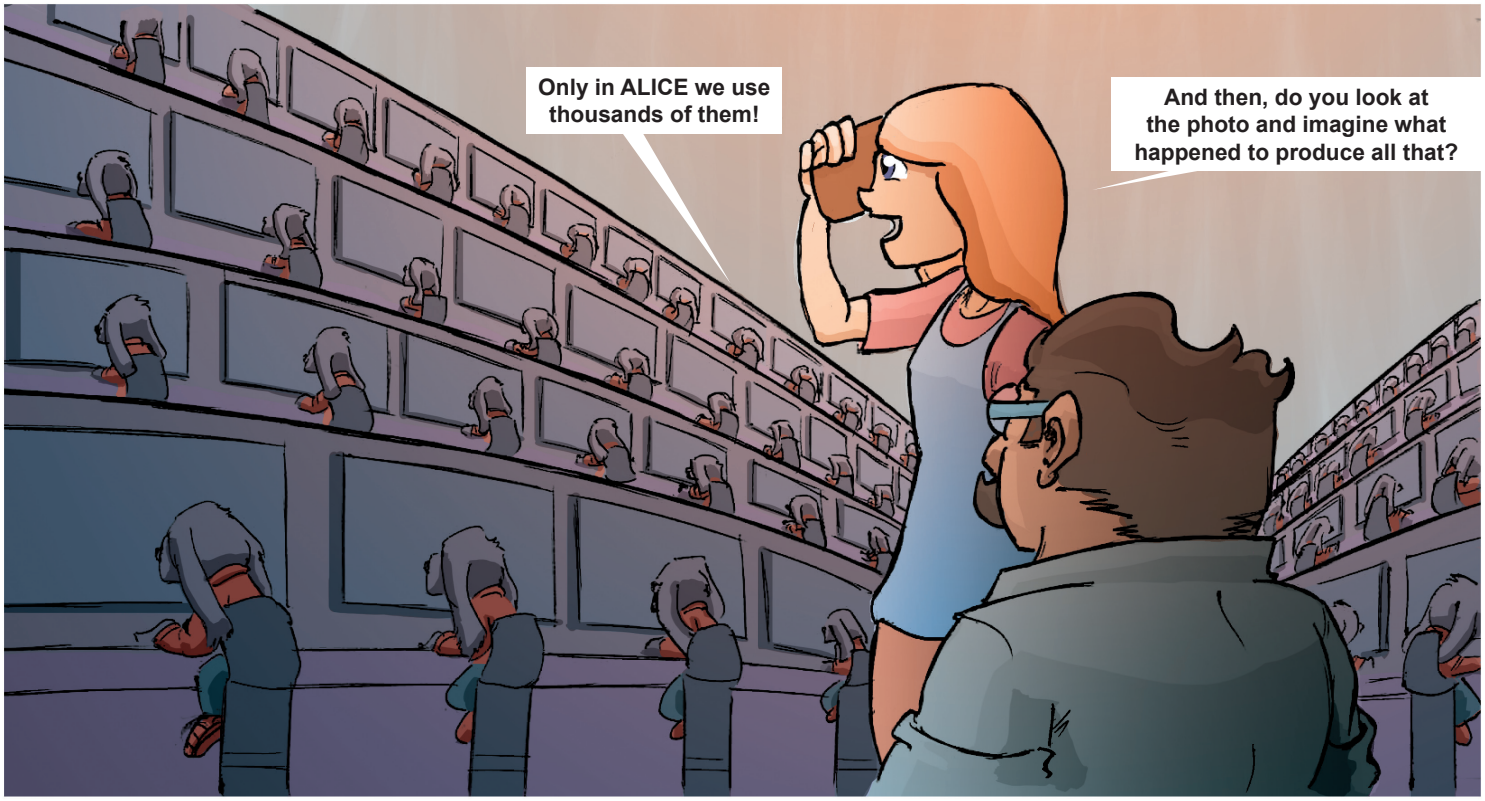

Ok, I see, so quarks, gluons and electrons are elementary particles. Can we see them with ALICE?
We create mini Big Bangs by bumping two nuclei into each other.
G
Q
P
LEAGUE
These collisions release an enormous amount of energy that liberates thousands of quarks and gluons normally imprisoned inside the nucleus.
It's ALICE's job to trace all these particles.


And how do you make the nuclei collide?
ALICE is directly on the path of the beams of nuclei that travel at the speed of light inside an accelerator called the Large Hadron Collider.
This is a 27 kilometre ring, sitting 100 metres underground.
Put your helmet and I'll show you around.
ALICE weighs as much as the Eiffel Tower, but it is small enough to fit under one of its pillars!
Inside the experiment magnet, there are several devices called detectors. Each has its own job to do.
Why? Is one detector not enough?
Particles are not all the same. And just as you can't catch a mouse with a fishing line, you need different detectors to trap electrons or catch protons.
ALICE assembles all kinds of detectors to make sure it measures every particle.
So do detectors allow you to see particles crossing space, like a microscope?
Yes, but you can't see them with your eyes.

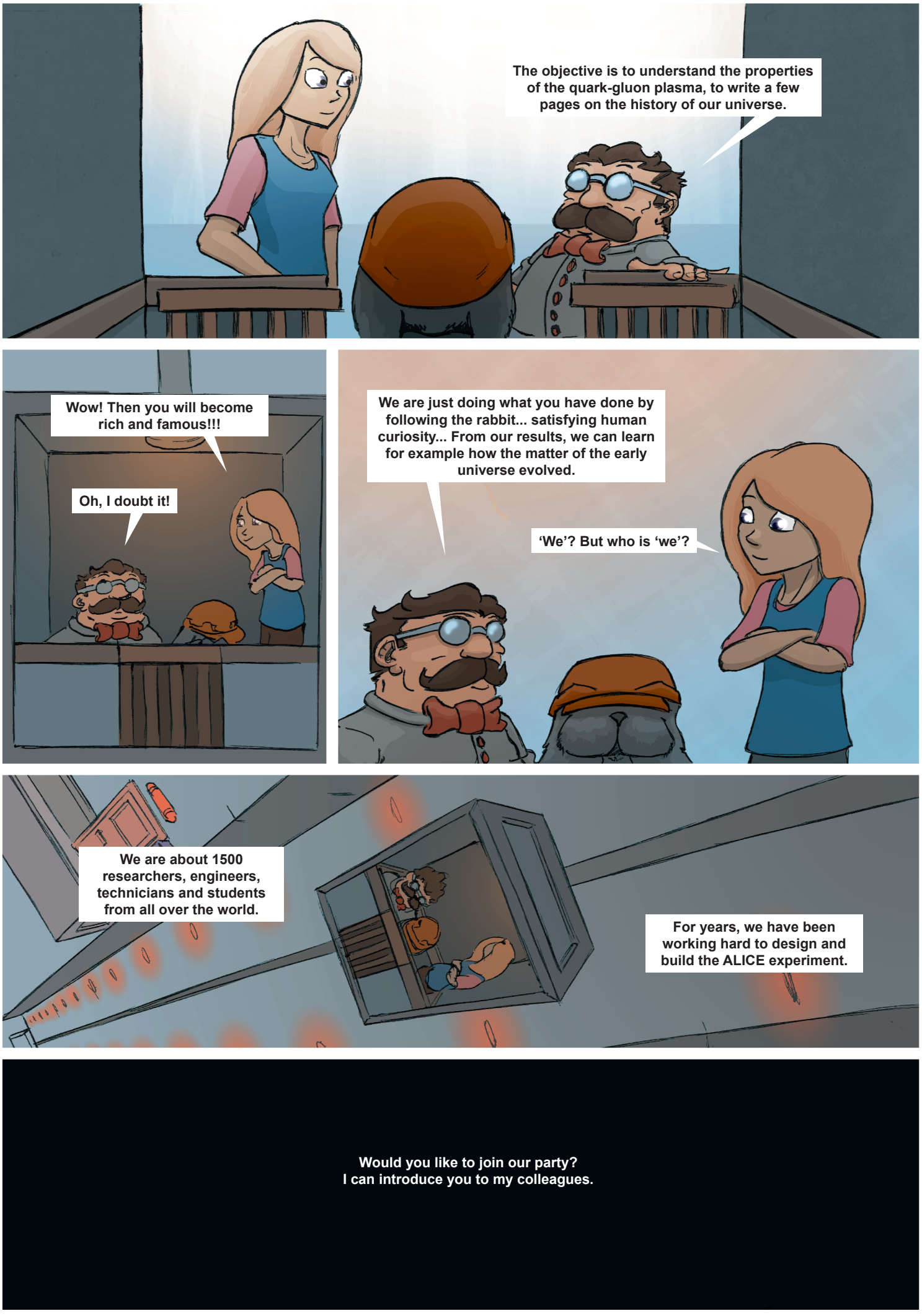

Let me give you a few examples.
Our biggest detector is filled with a special gas mixture.
When particles travel through this gas, they leave behind them a trace.
By observing these traces, scientists can recognize the particles, the same way that an experienced hunter can distinguish a rabbit from a deer by looking at their footprints.
So you do not see directly the particles?
Exactly, we see the trace they leave! Another detector can measure, with much better precision than a Swiss watch, the time particles take to travel from one point to another.
Having received the same energy, the heavier particles will travel more slowly than the lighter ones.
Are there particles too light and too fast to actually catch?
There is a particle that has no mass and travels at exactly the speed of light.


This is the light itself, which is made of particles called photons. To catch photons we need a very heavy crystal, as dense as lead and as transparent as glass.
How do you see the traces of these particles if ALICE is closed? Do you take a photograph?


Right again! Each detector is equipped with electronics that analyse all the traces, collect the information in digital form and send it to computers, such as the one you have at home for surfing the internet.


Only in ALICE we use thousands of them!
And then, do you look at the photo and imagine what happened to produce all that?


Billions of photos are taken and it takes hundreds of scientists all over the world to look at all of them. The scientists work together in groups. They imagine various scenarios, and compare them to their findings to see which fits best.


The objective is to understand the properties of the quark-gluon plasma, to write a few pages on the history of our universe.
Wow! Then you will become rich and famous!!!
Oh, I doubt it!
We are just doing what you have done by following the rabbit... satisfying human curiosity... From our results, we can learn for example how the matter of the early universe evolved.
'We'? But who is 'we'?
We are about 1500 researchers, engineers, technicians and students from all over the world.
For years, we have been working hard to design and build the ALICE experiment.
Would you like to join our party?
I can introduce you to my colleagues.

Some members of the ALICE team