Top Ten Mysteries of the Universe
Who wants to be a millionaire?

Who wants to be a Septillionaire?

(10,000,000,000,000,000,000,000,000,000,000,000 p)
The Leptons
Light and electrifying ...

The quarks
Strong and colourful ...

Contestants

Quiz master

Rolf Landua
CERN
TOP 10 MYSTERIES OF THE EARLY UNIVERSE

No. 10

What is CERN?
TOP 10 MYSTERIES OF THE EARLY UNIVERSE

10 CERN

What does C.E.R.N. stand for?

A  Central European Radiation Network
B  Centre Eternel pour la Recherche Non-appliquée
C  😊  Conseil Européen pour la Recherche Nucléaire
D  Center for European Research Nerds
What are the goals of CERN research?

- Improve nuclear reactors
- Improve the WWW
- Study matter, fields and The origin of the Universe
- Thermonuclear warfare
Large Hadron Collider
The ‘Large Hadron Collider’ accelerates $3 \times 10^{14}$ protons (~0.5 ng, small grain of dust) to $99.99999999\%$ of the speed of light.

What does the energy of the proton beams correspond to:

A hit with a sledgehammer

A frontal collision of two cars at 100 km/h

A herd of 1000 elephants at 30 m/s

About 3 µg of antimatter
What would happen to this theoretical physicist if he circulated in the LHC machine with 99.9999999% of the speed of light?

A. 😞 His hair would contract to 0.05 mm length
B. 😊 He would have the same energy as 500 tons of matter
C. 😊 We would observe his life span to be ~ 500,000 yrs
D. 😞 He may suffocate before reaching this age
CERN in 3 minutes

QuickTime™ and a H.264 decompressor are needed to see this picture.
Particles
What are the smallest building blocks of matter?

A  Molecules
B  Atoms
C  Electrons and Quarks
D  Protons and Neutrons
How many different types of matter particles exist?
Why are there so many types of matter particles?

A. We don’t know
B. Stephen Hawking knows
C. God knows
D. A throw of the dice during the Big Bang
Forces
Is the electromagnetic force stronger than gravitation?

A. Yes, 100 \((10^2)\) times
B. Yes, 100 million \((10^8)\) times
C. Yes, \(10^{36}\) times
D. No, gravitation is stronger.
Gravitation is stronger 100 (10^2) times

100 million (10^8) times

Gravitation is the dominant force in the Universe

BUT MATTER IN THE UNIVERSE IS NEUTRAL, because positive and negative charges cancel each other precisely.

THEREFORE:
Gravitation is the dominant force in the Universe.
The Big Bang
How old is the Universe?

A 5,800 years
B 4.55 billion years
C 😊 13.7 billion years
D It has been going on for e
What did the Big Bang produce during its first few minutes?

A) The Earth
B) The stars
C) All elementary particles
D) Cosmic Rays
Antimatter
Every particle has an ‘anti-particle’. Compared to the particle, the anti-particle has:

- **A** Same mass, same charge
- **B** Same mass, opposite charge
- **C** Opposite mass, same charge
- **D** Opposite mass, opposite charge

Electron and Positron

**5 Antimatter**
Where is the largest concentration of antimatter in the known Universe?

A. Under the Vatican
B. Andromeda Galaxy
C. Starship ‘Enterprise’
D. 😊 Particle accelerators
The disappearance of antimatter in the Universe

QuickTime™ and a MPEG-4 Video decompressor are needed to see this picture.

Blue = Matter particles; Red = Antimatter particles
Time scale during Big Bang < 0.000 001 sec
Space and Time
TOP 10 MYSTERIES OF THE EARLY UNIVERSE

4 Space and Time

How many dimensions has space?

A. 2 (the Earth is flat!)
B. 😊 3
C. 4
D. 3 big ones, 6 small ones
How does the presence of matter change space and time?

A. It bends it like a rubber sheet
B. It blows it up like a balloon
C. It makes time go faster
D. It makes time go slower
TOP 10 MYSTERIES OF THE EARLY UNIVERSE

No. 3

Black Holes
How is a black hole formed?

A. By antimatter
B. 🧐 In the collapse of a massive star
C. By spending too much money
D. By collisions in the LHC
What happens to John when he falls into a black hole?

A. He never arrives
B. He becomes flat as a pancake
C. Gravity rips him apart
D. Nothing
Black Holes and Vampire Stars

QuickTime™ and a MPEG-4 Video decompressor are needed to see this picture.
Dark Matter
TOP 10 MYSTERIES OF THE EARLY UNIVERSE

2 Dark Matter

How do we know that Dark Matter must exist?

A. We don’t know for sure
B. By looking through big telescopes
C. My missing socks must have gone somewhere
D. My theory predicts it
How do we know about “dark matter”
What is dark matter made of?

A. Black Holes
B. Weakly Interacting Massive Particles
C. Planets beyond the solar system
D. Neutrinos
How could we detect ‘dark matter’?
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And the Top Mystery is ....
The recipe for the Universe
What is the Universe made of?

A. ☺️ Quarks and electrons
B. ☻️ Dark matter
C. ☹️ A mysterious type of energy
D. ☺️ Sex, Drugs and Rock’n Roll

TOP 10 MYSTERIES OF THE EARLY UNIVERSE

1. Dark Energy
How do we know about “dark energy”? 

A ☑️ From observing distant exploding stars
B ☑️ From observing the TV
C ☑️ From observing the cosmic background radiation
D ☑️ Einstein predicted it
How will the Universe end?

A ☺ It will expand faster and faster
B It will collapse in the Big Crunch
C Everything will fall into Black Holes
D ‘World of Warcraft’ becomes core subject in syllabus
... and the
10,000,000,000,000,000,000,000,000 proton award goes to ...