Why are we here?
Origin of Universe and Ourselves

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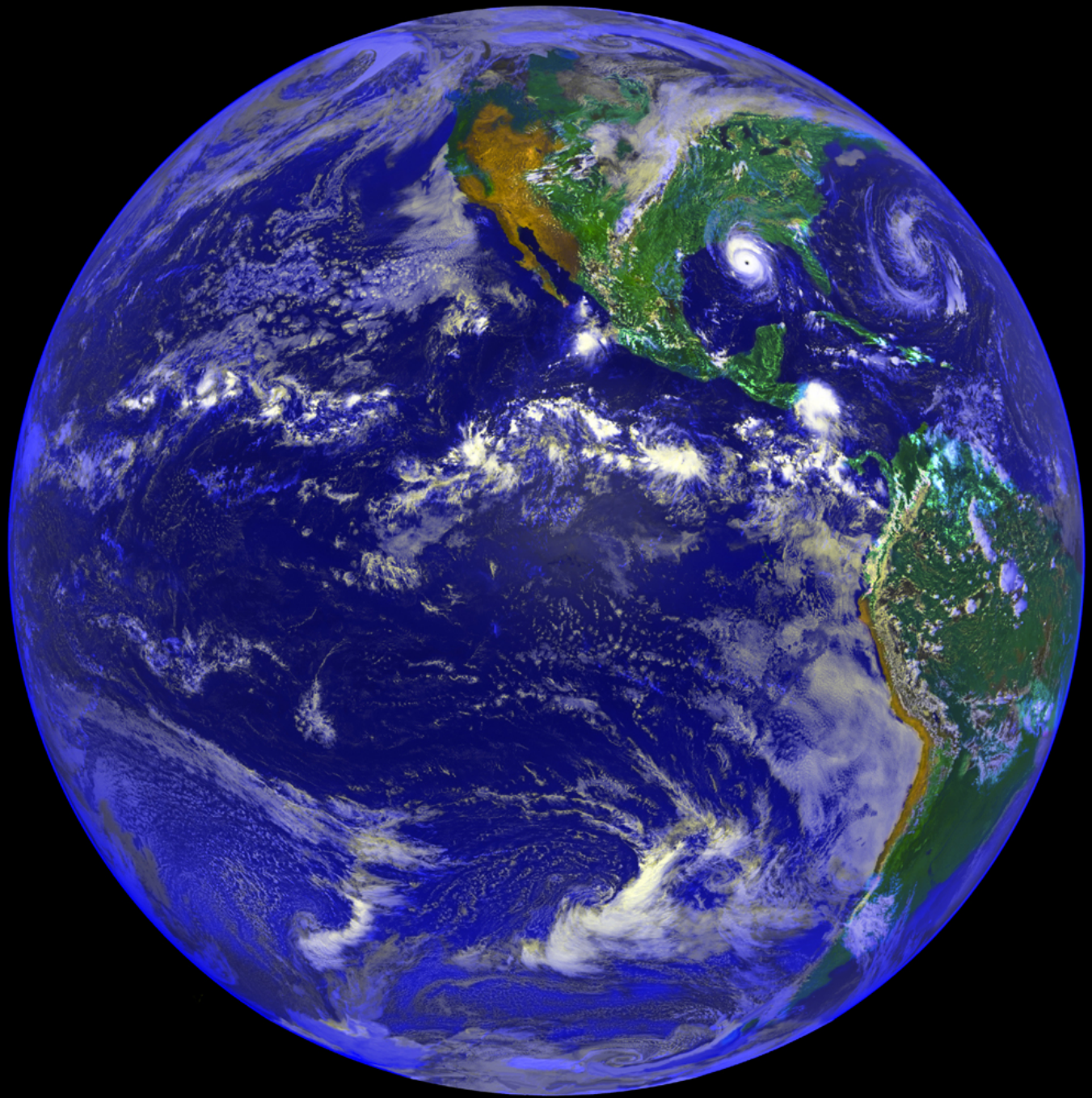
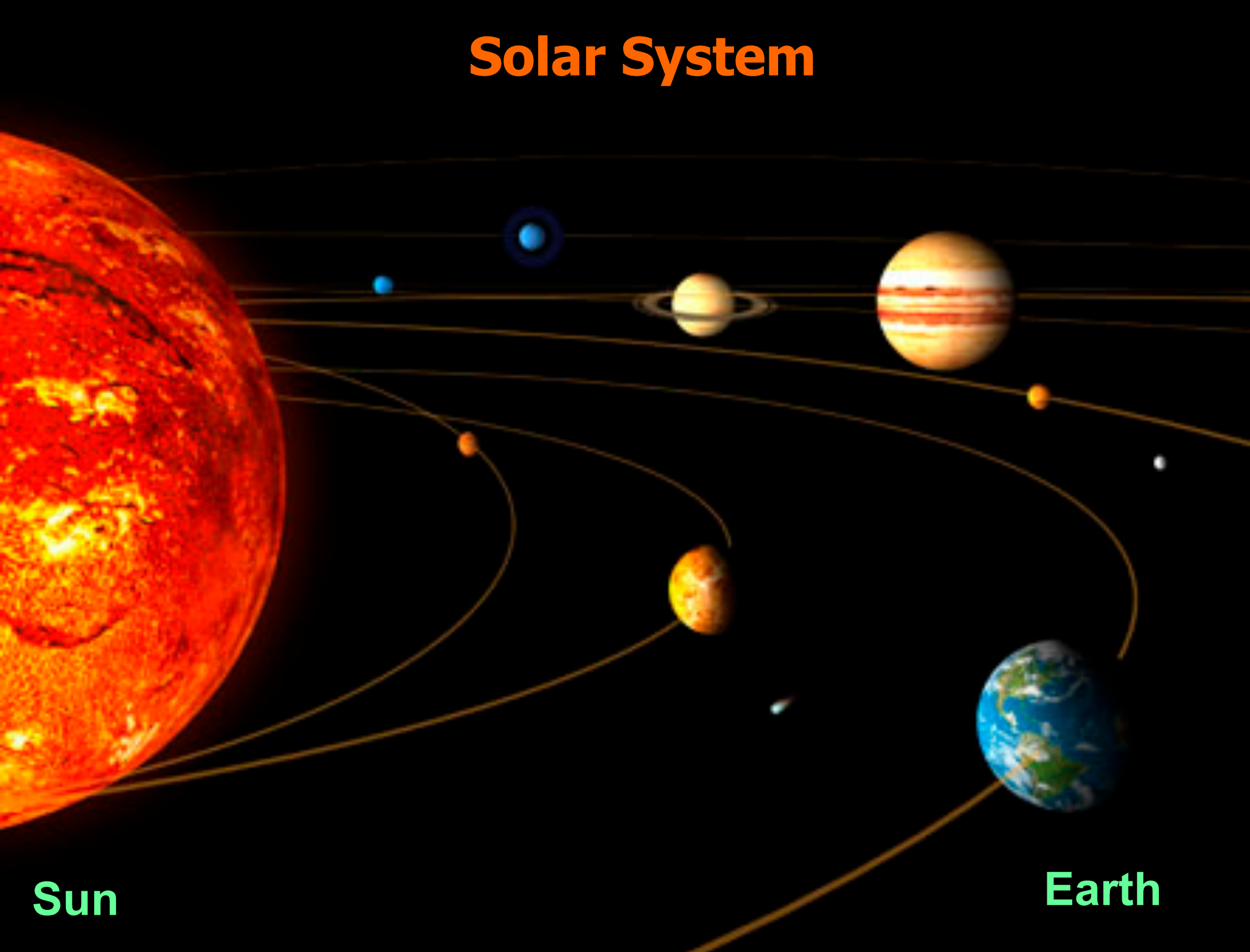
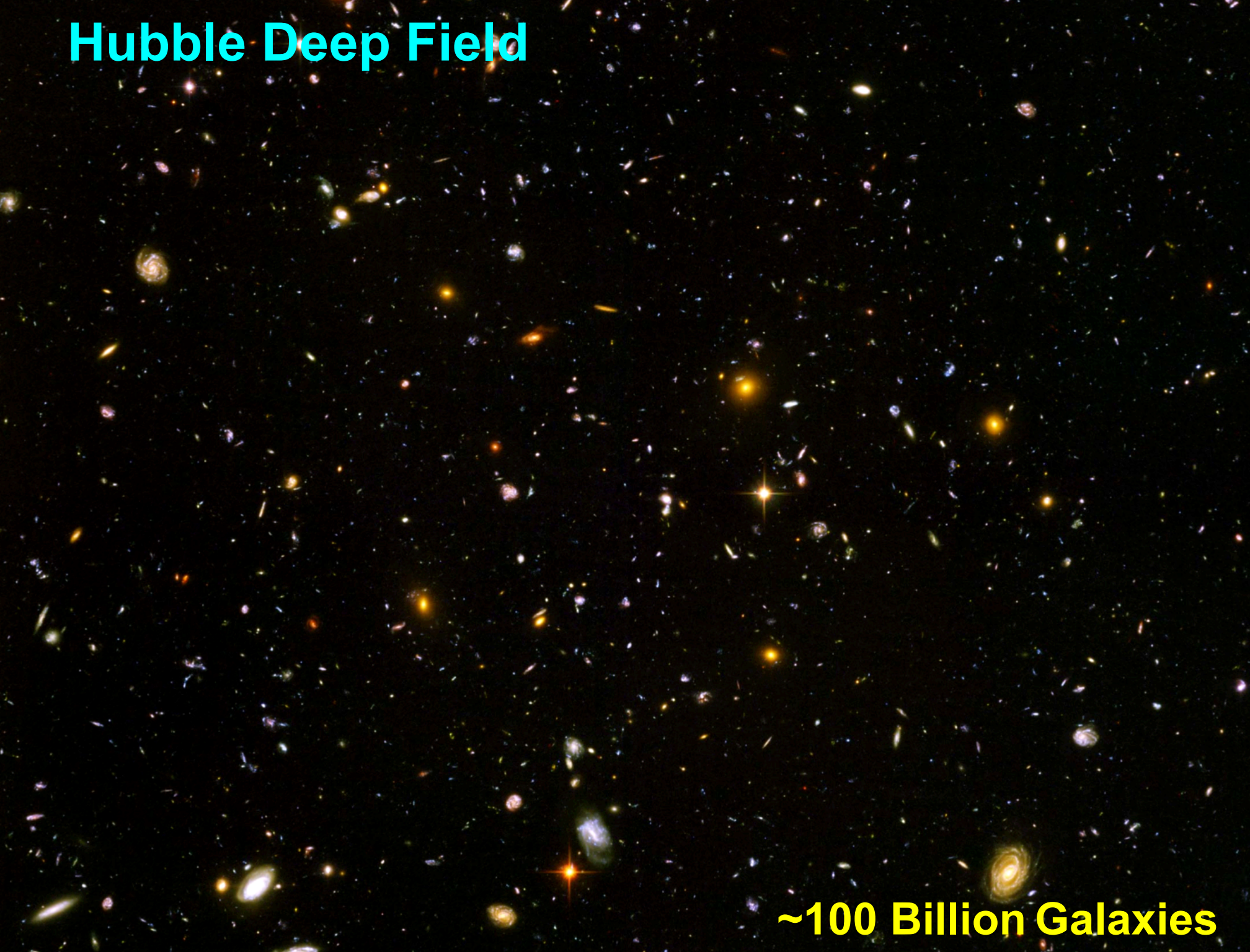


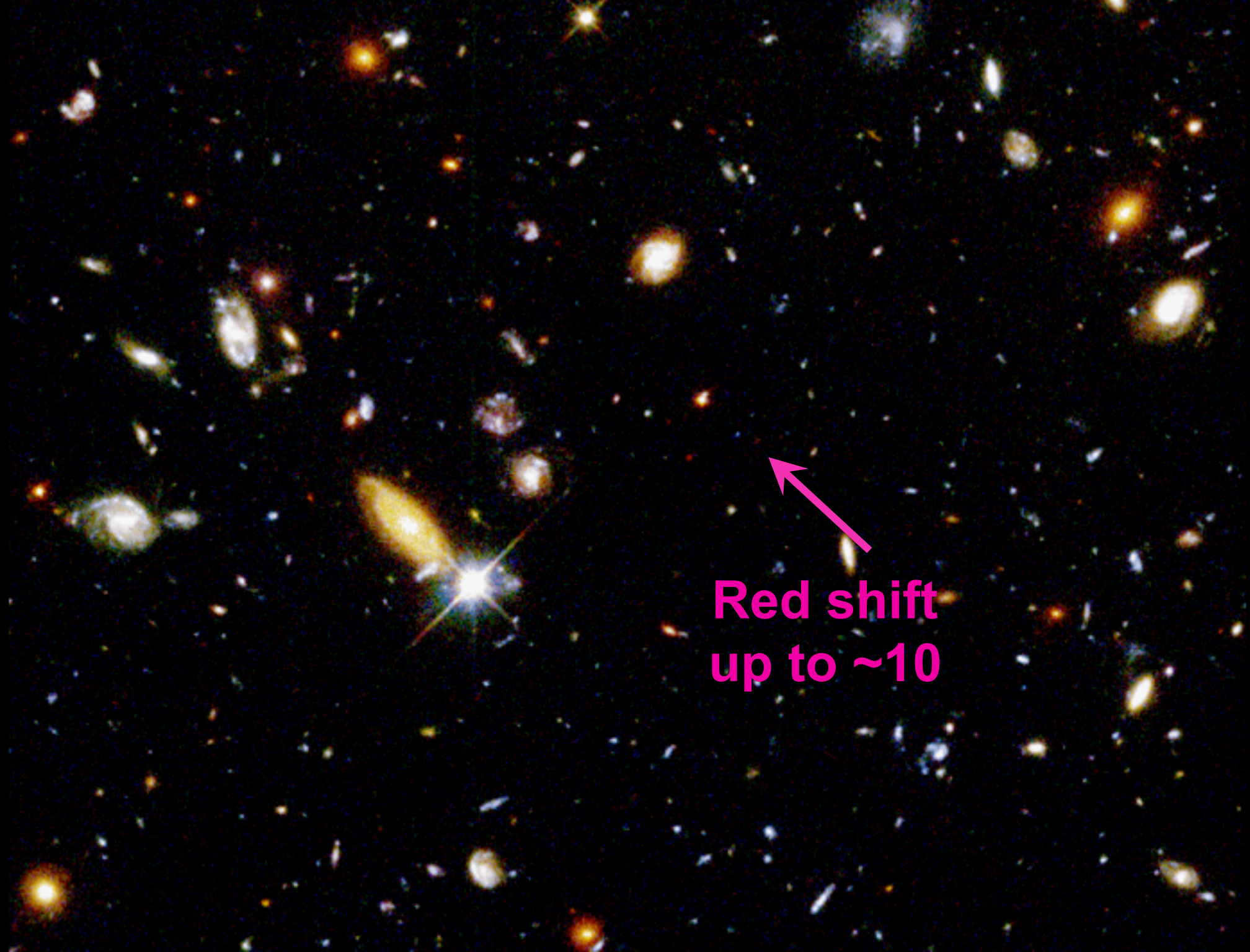
Why are we here?

Solar System



~100 Billions Stars in a Galaxy

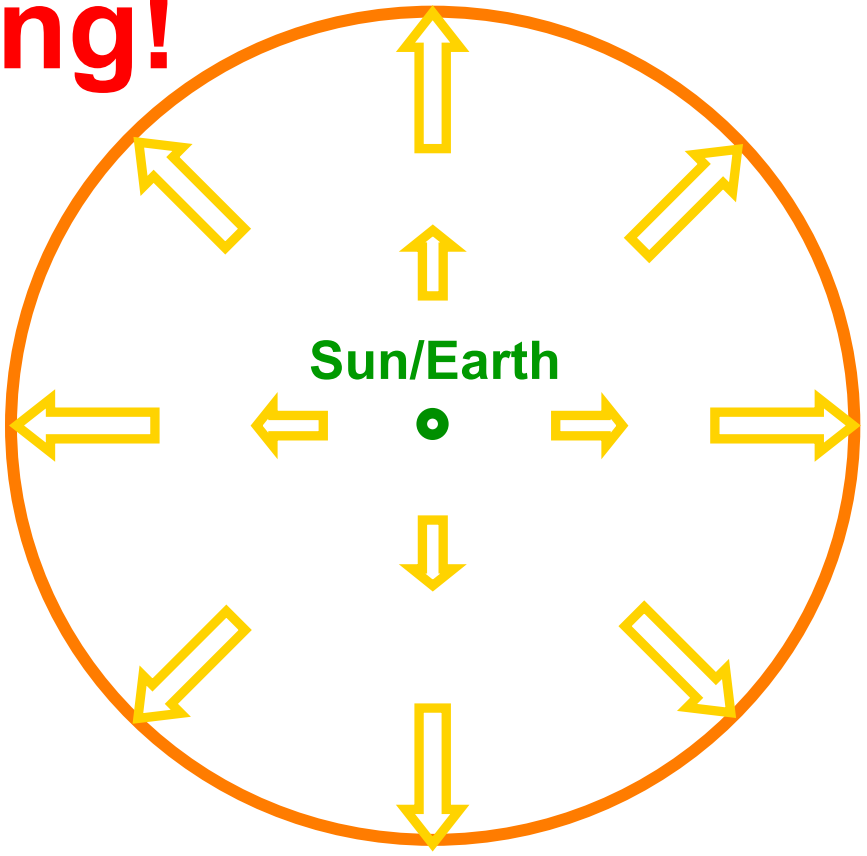

Hubble Deep Field
~100 Billion Galaxies


Red shift
up to ~10

Hubble's Law: Expansion of the Universe

Big Bang!

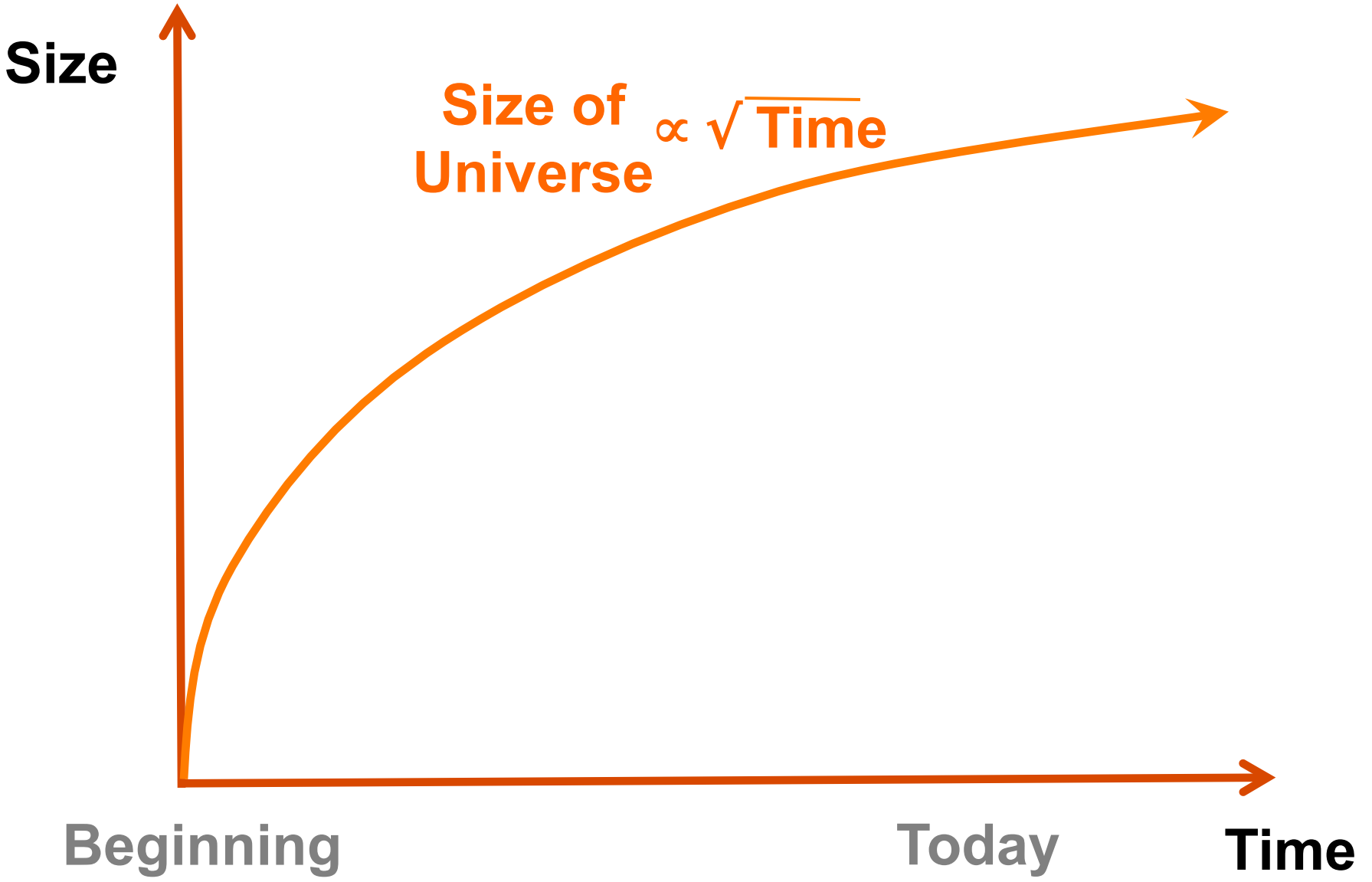
Horizon of Universe



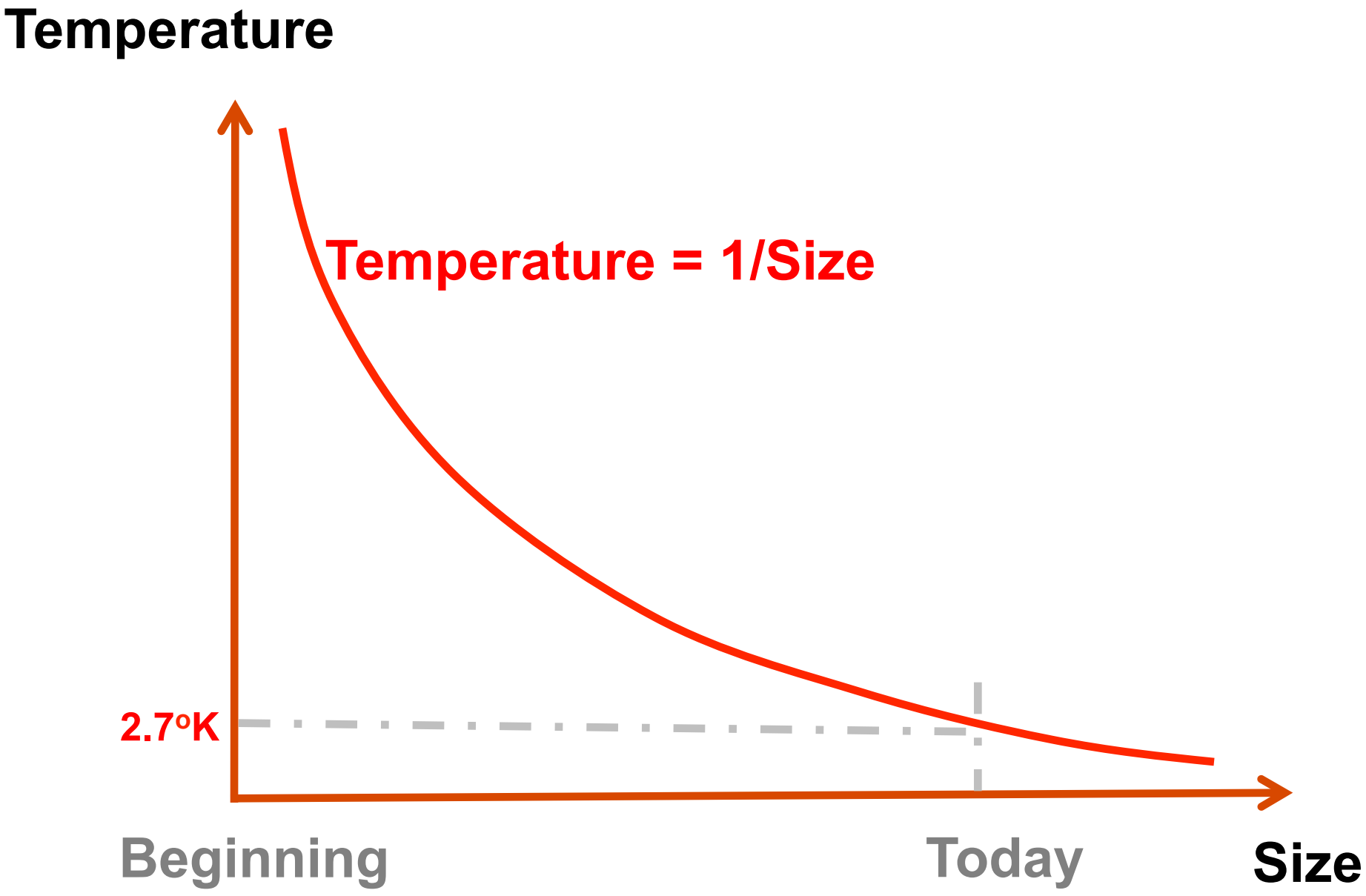
14 Billon Light Years

Moving Away at Speed of Light

Expansion of Universe

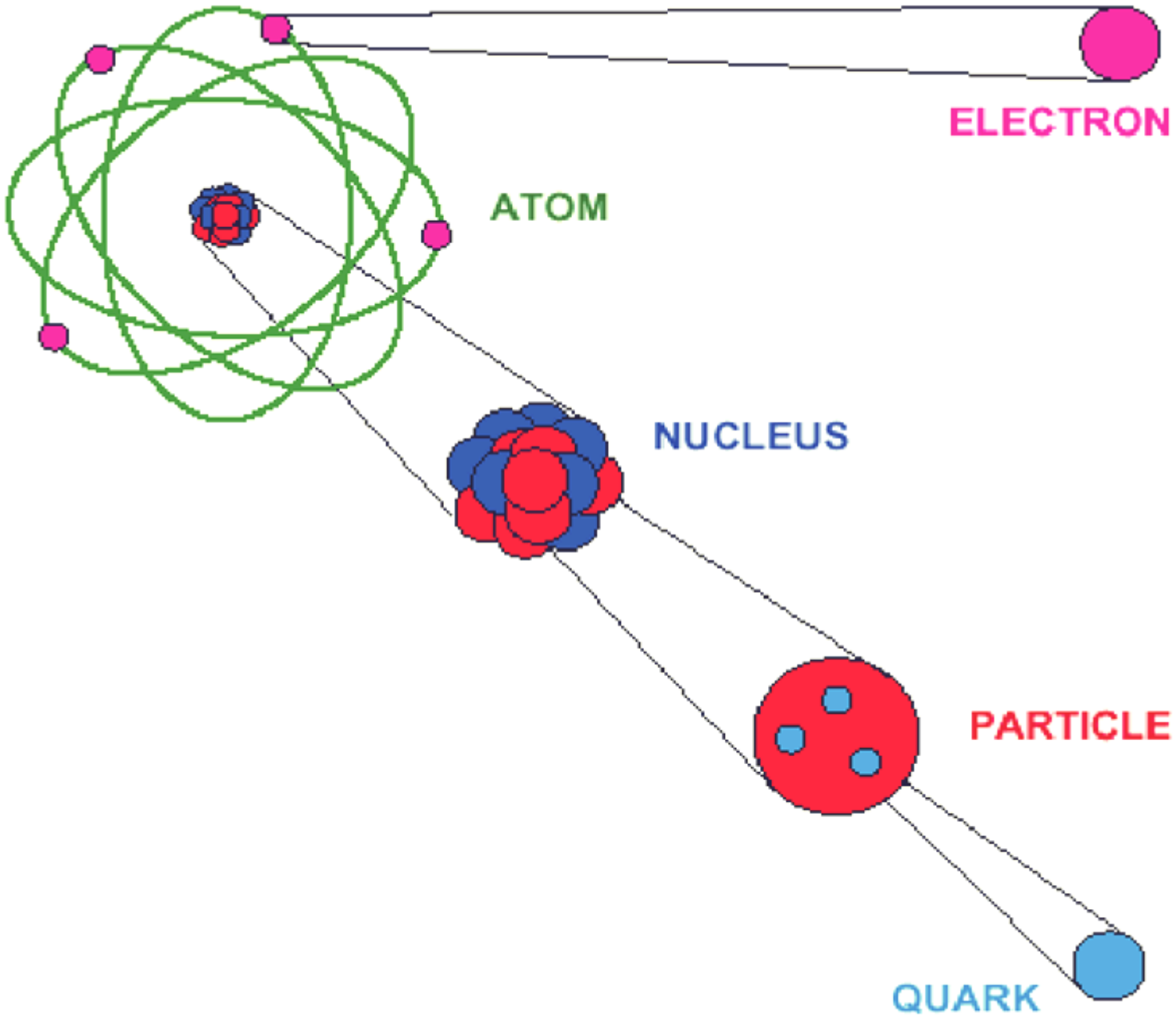


Temperature of Universe

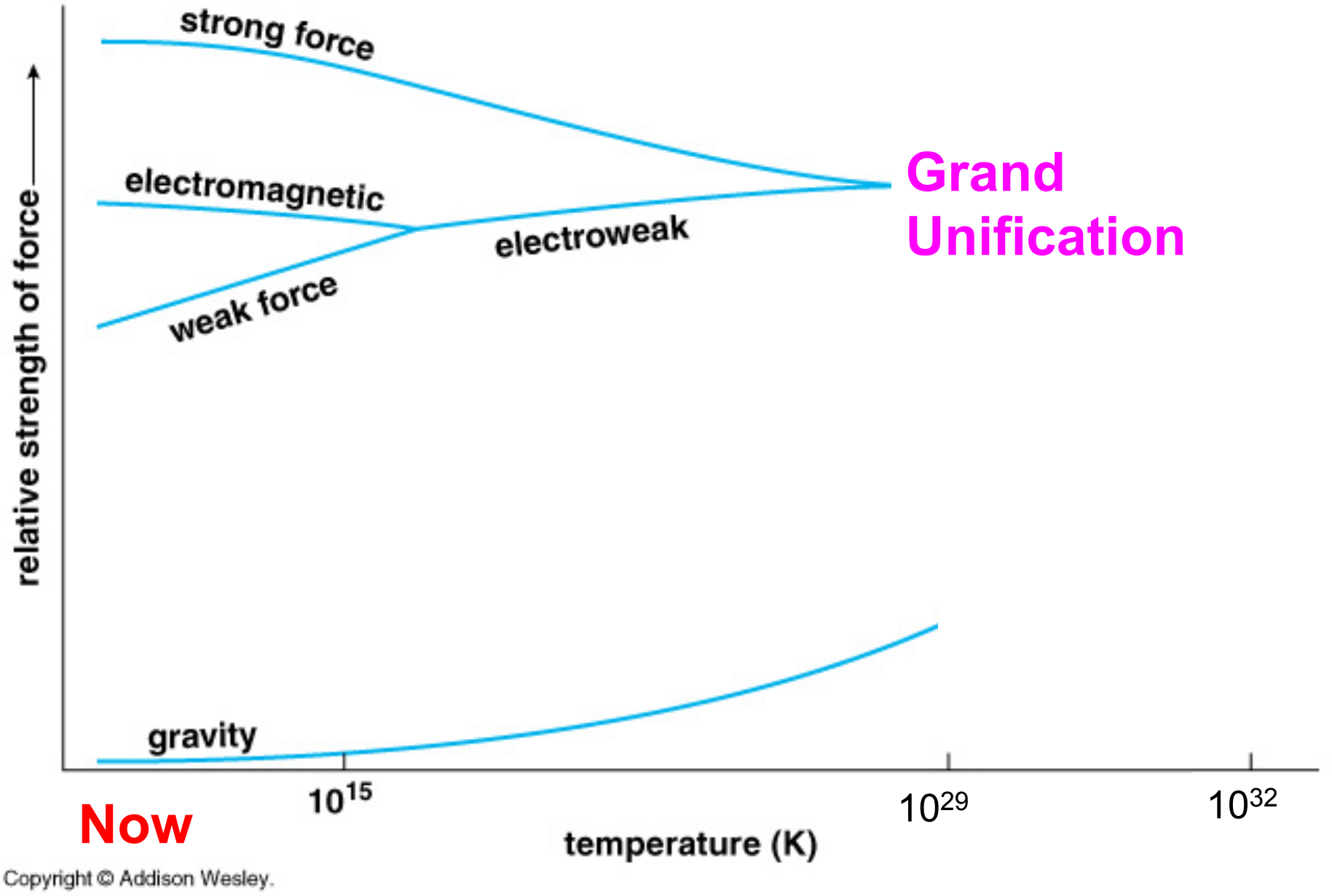


Tevatron at Fermi Lab near Chicago (1980 – 2010)

Elementary Particles



Unification of Four Forces



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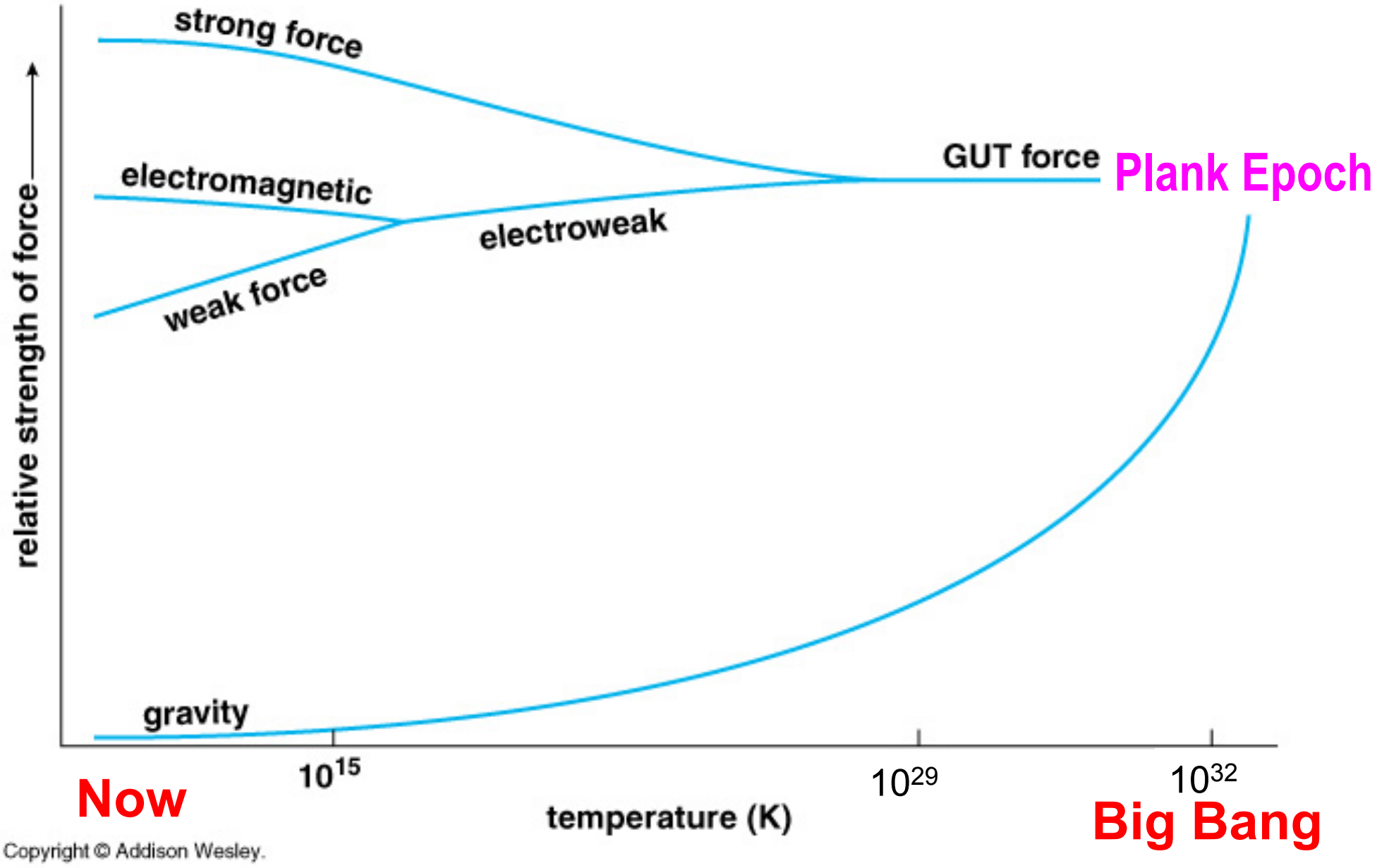
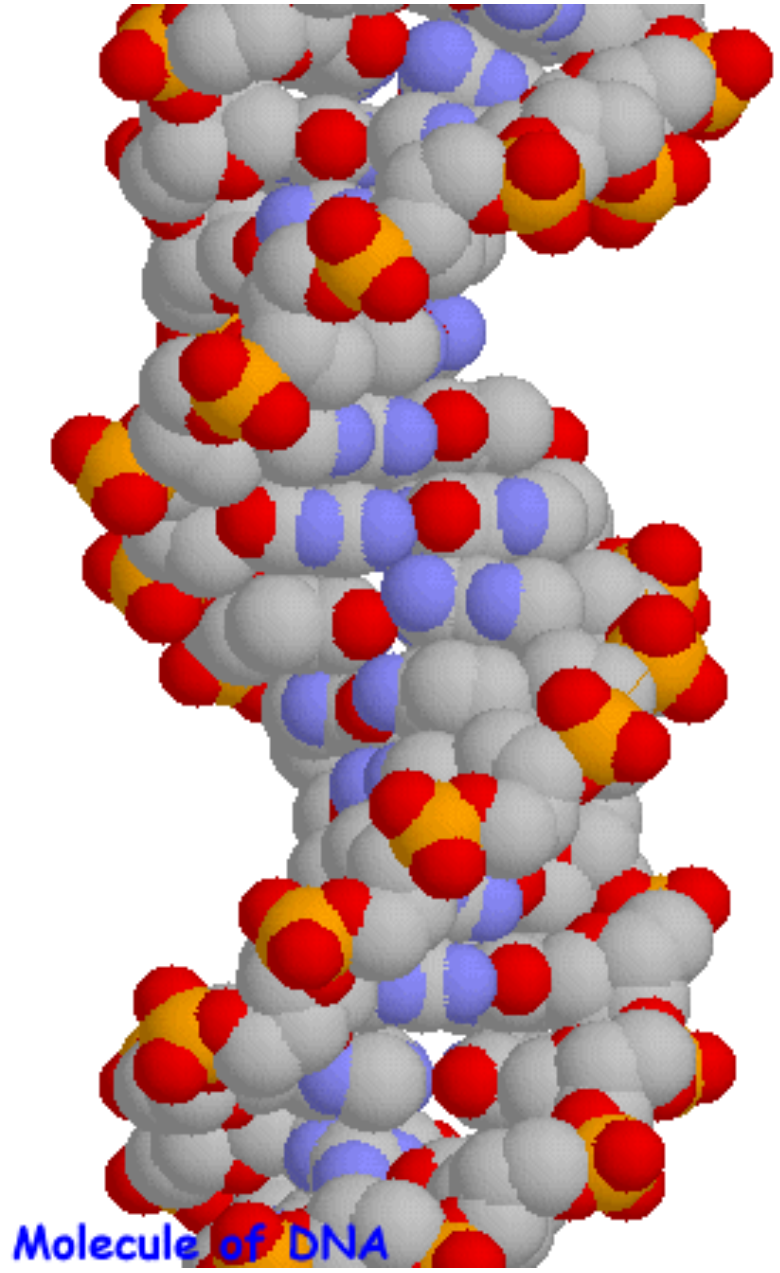


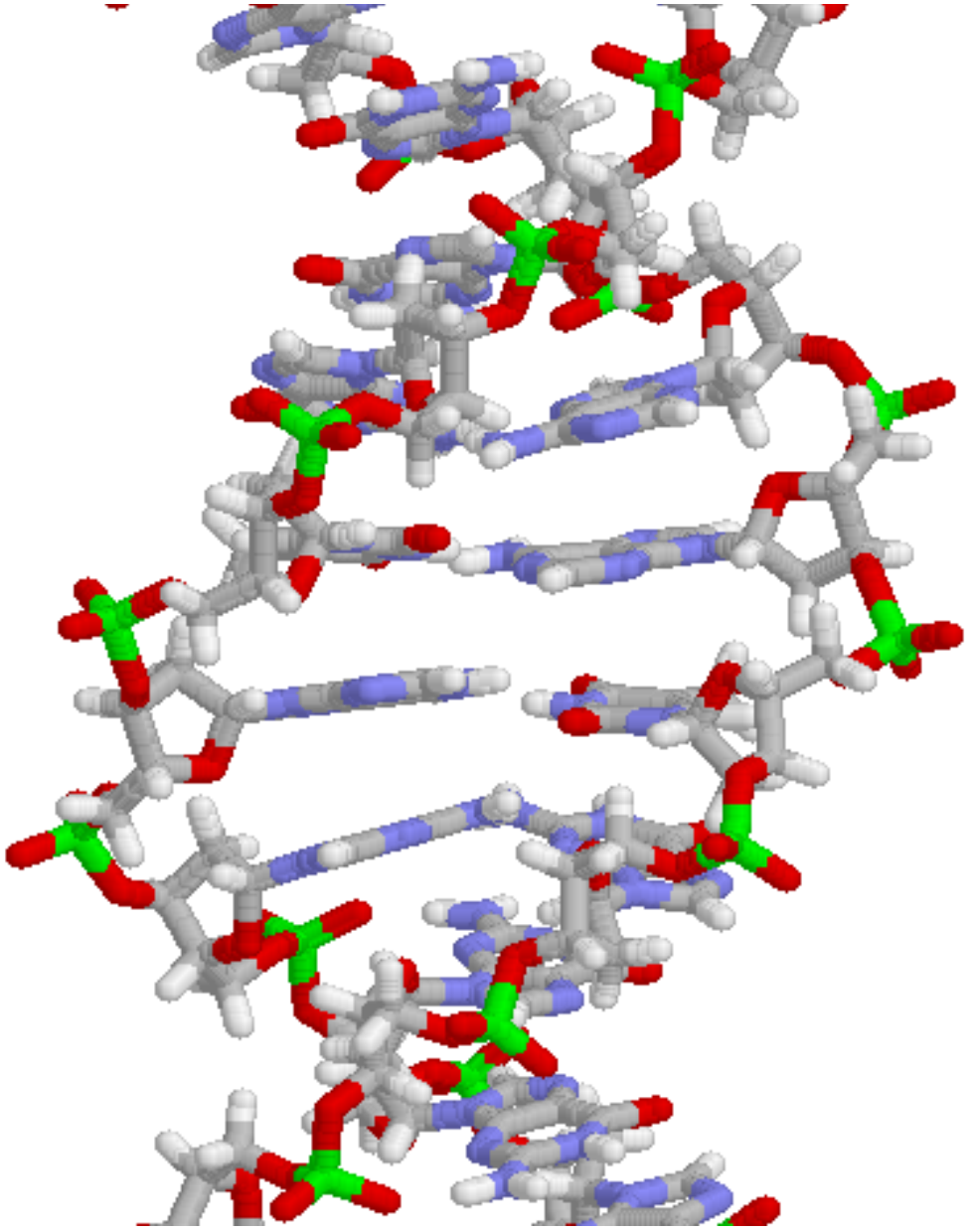
Physicists' View of Early Universe

Fiat lux

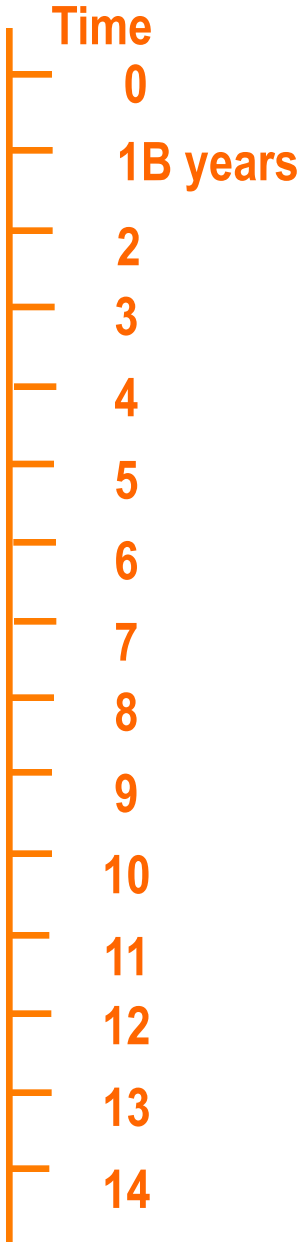
Let there be light

Structure of DNA



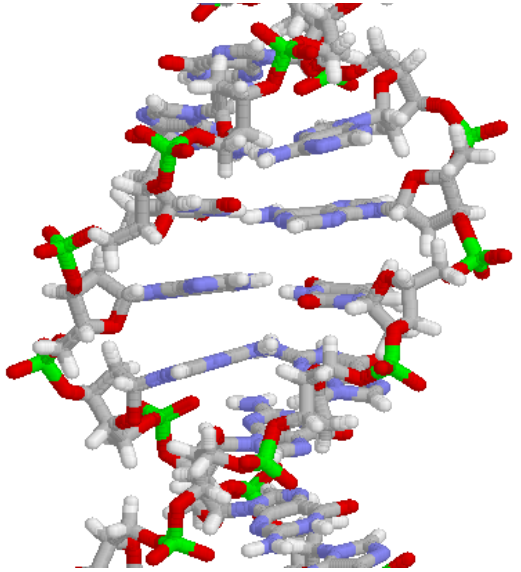


Symmetry Breaking



Simple

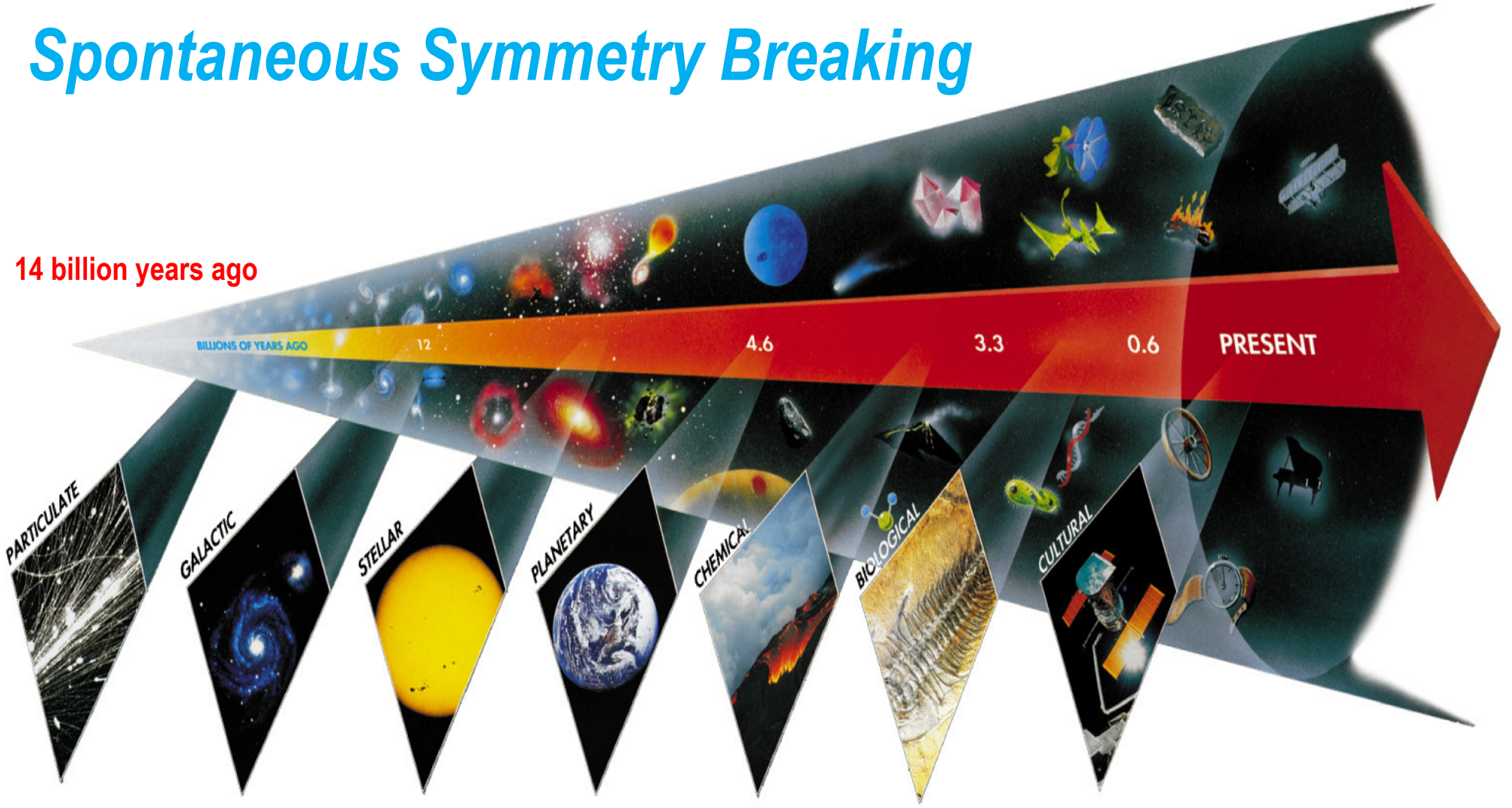
Symmetry Break Down



Complex

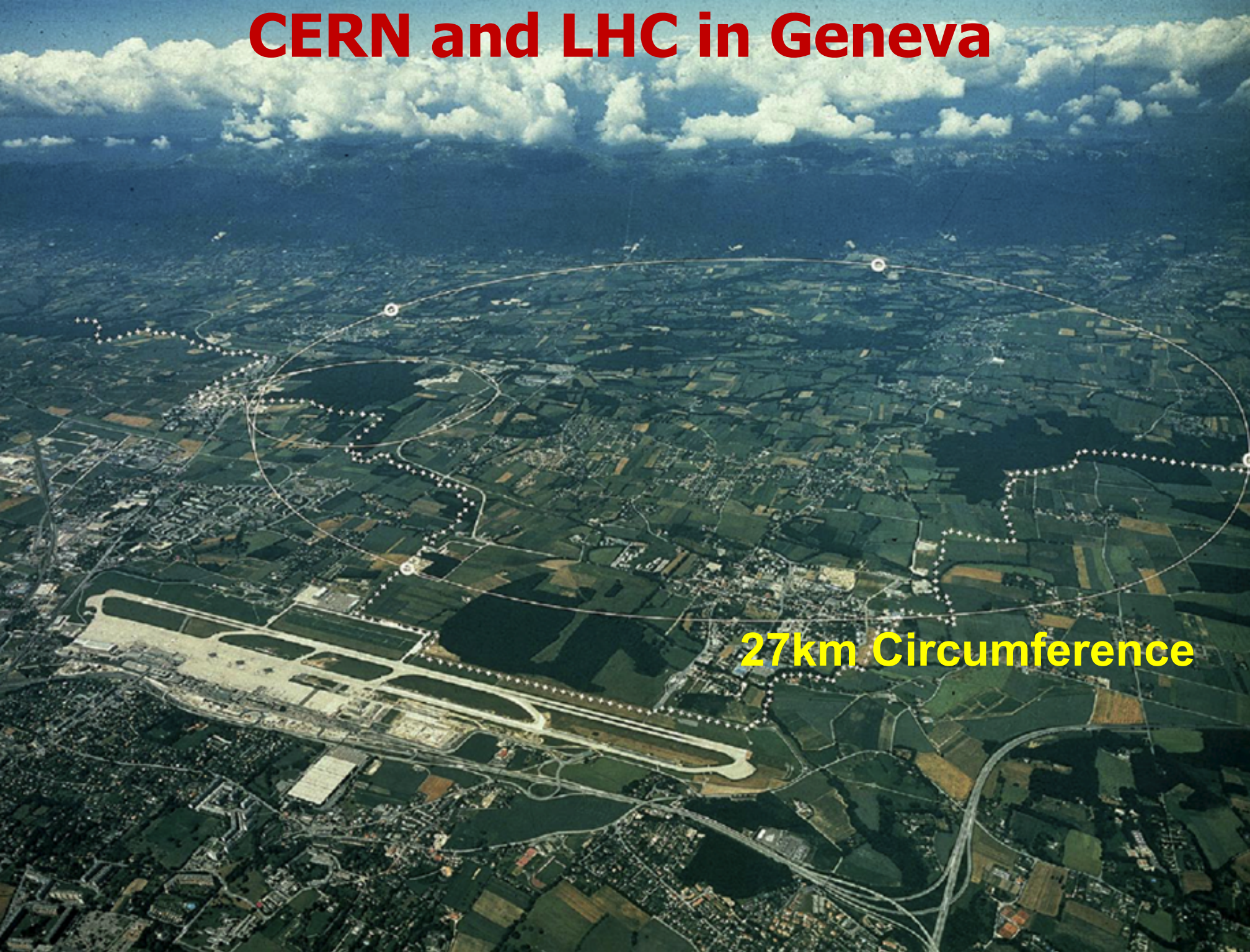
Seven Phases of Cosmic Evolution

Spontaneous Symmetry Breaking

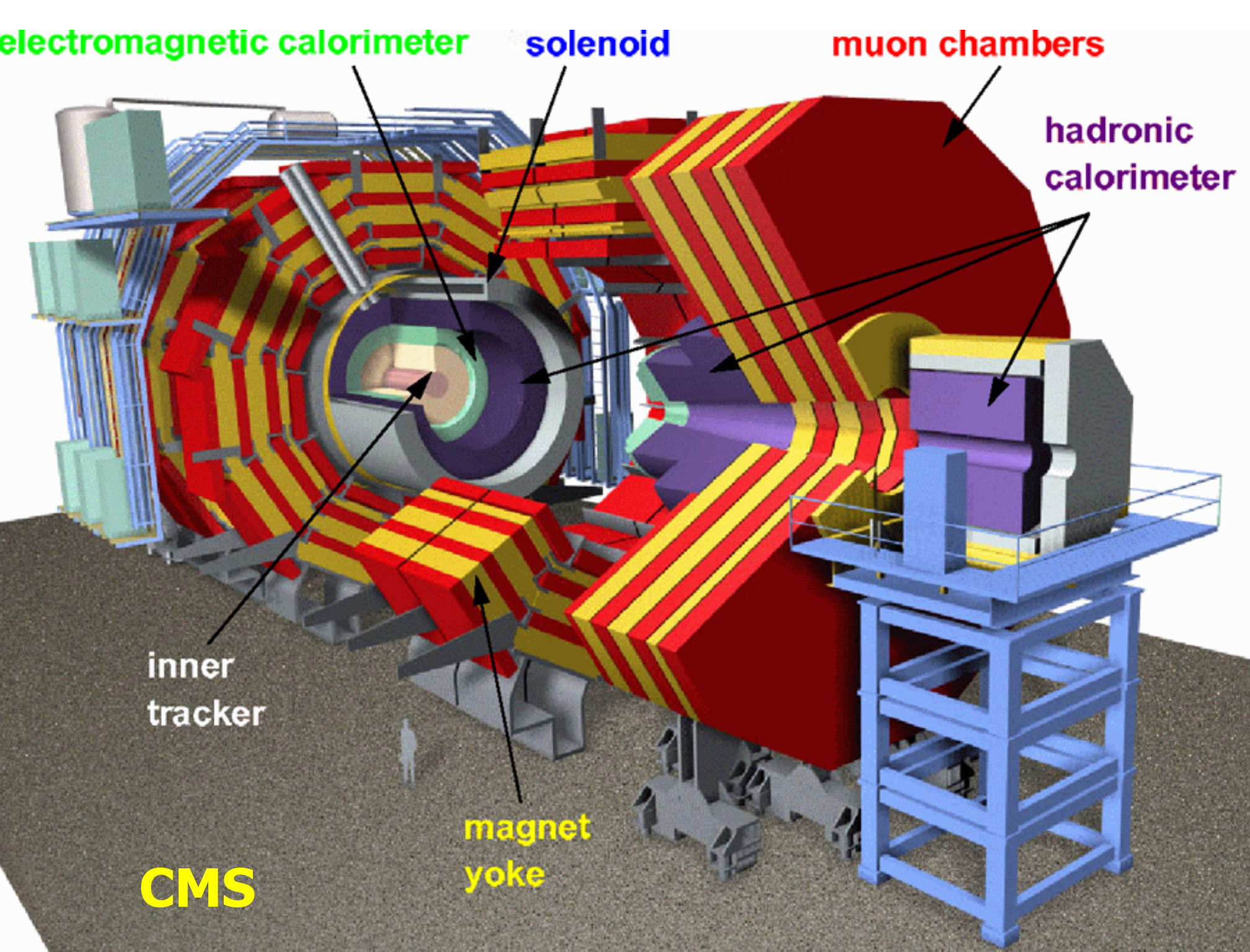


Origin of Particles

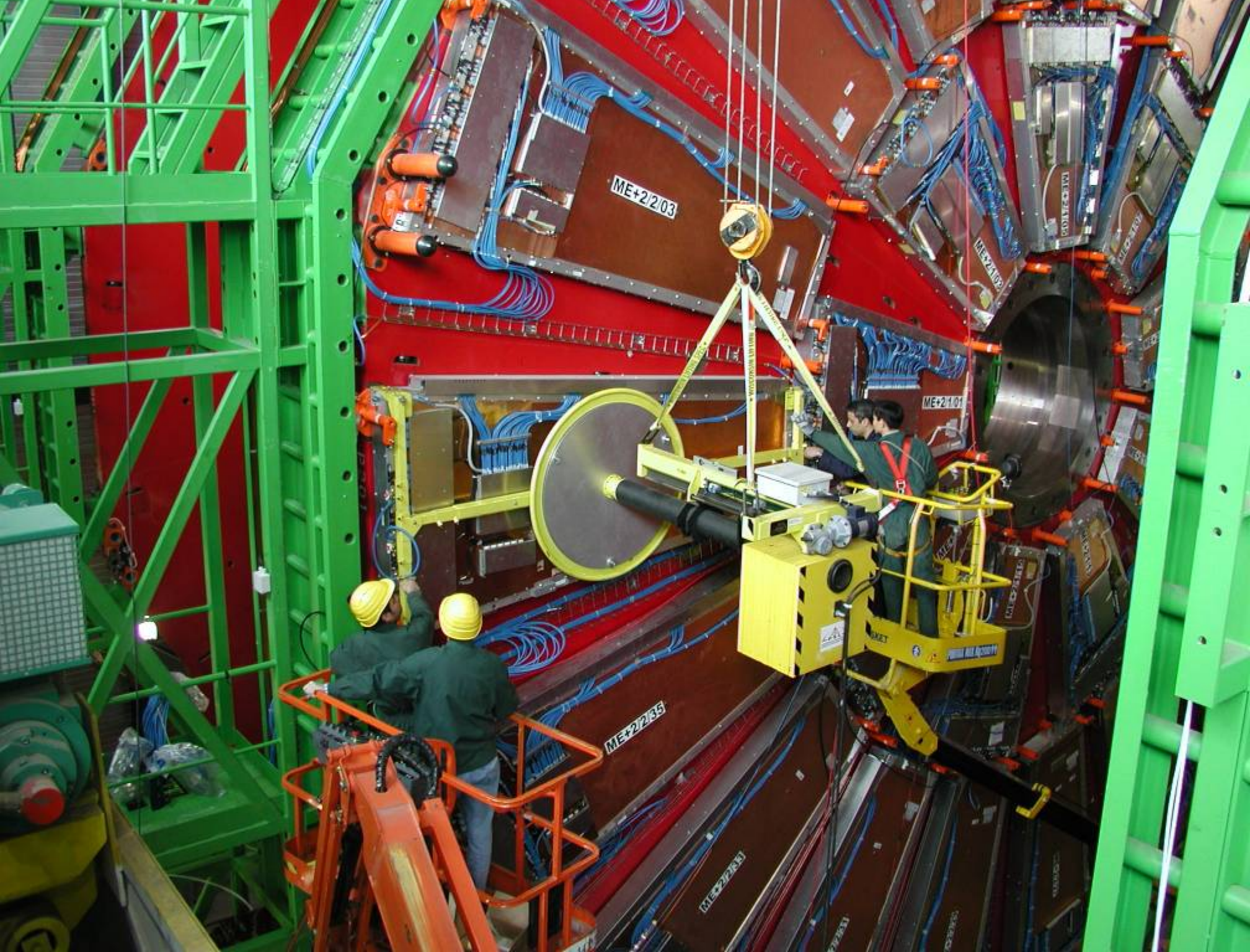
CERN and LHC in Geneva

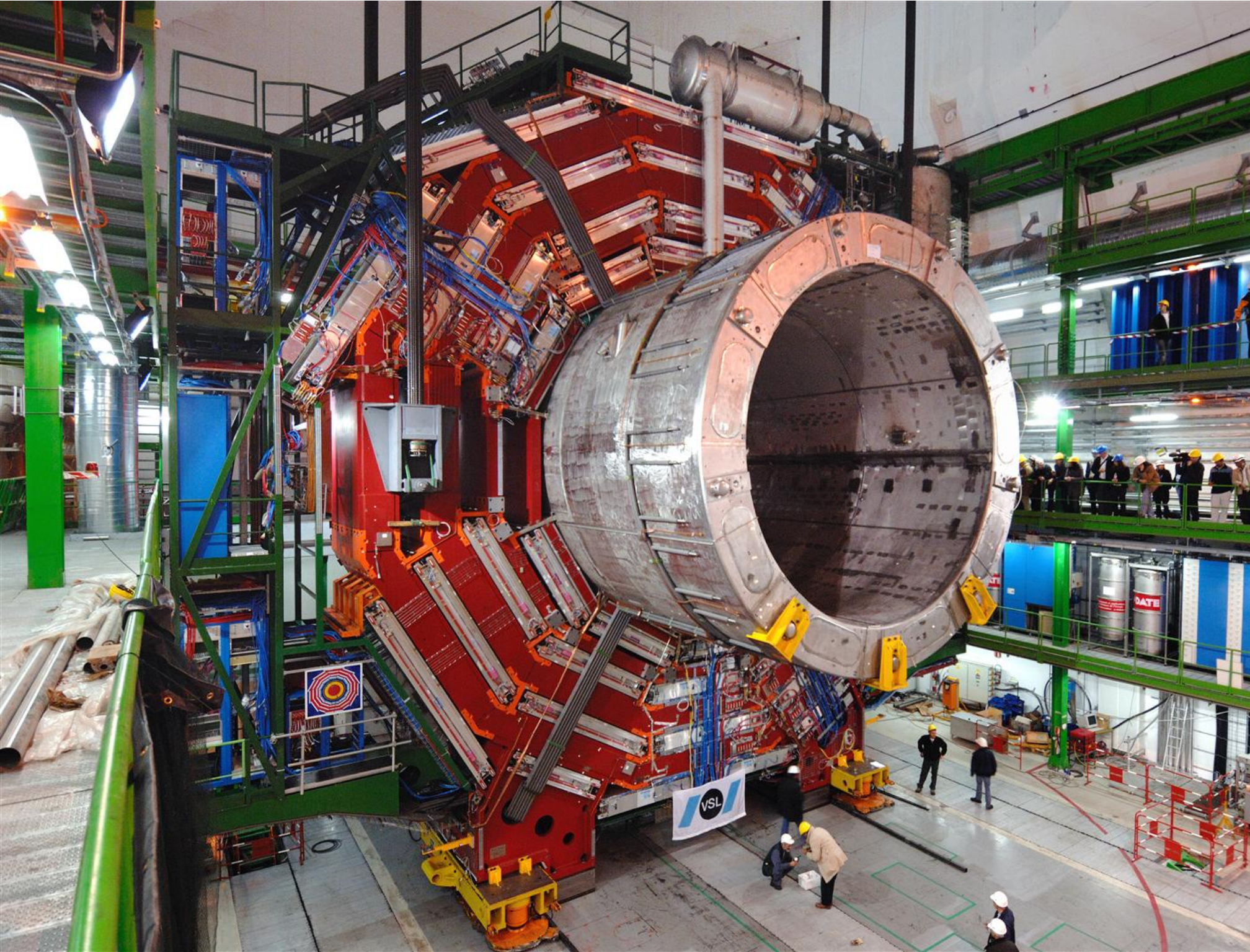


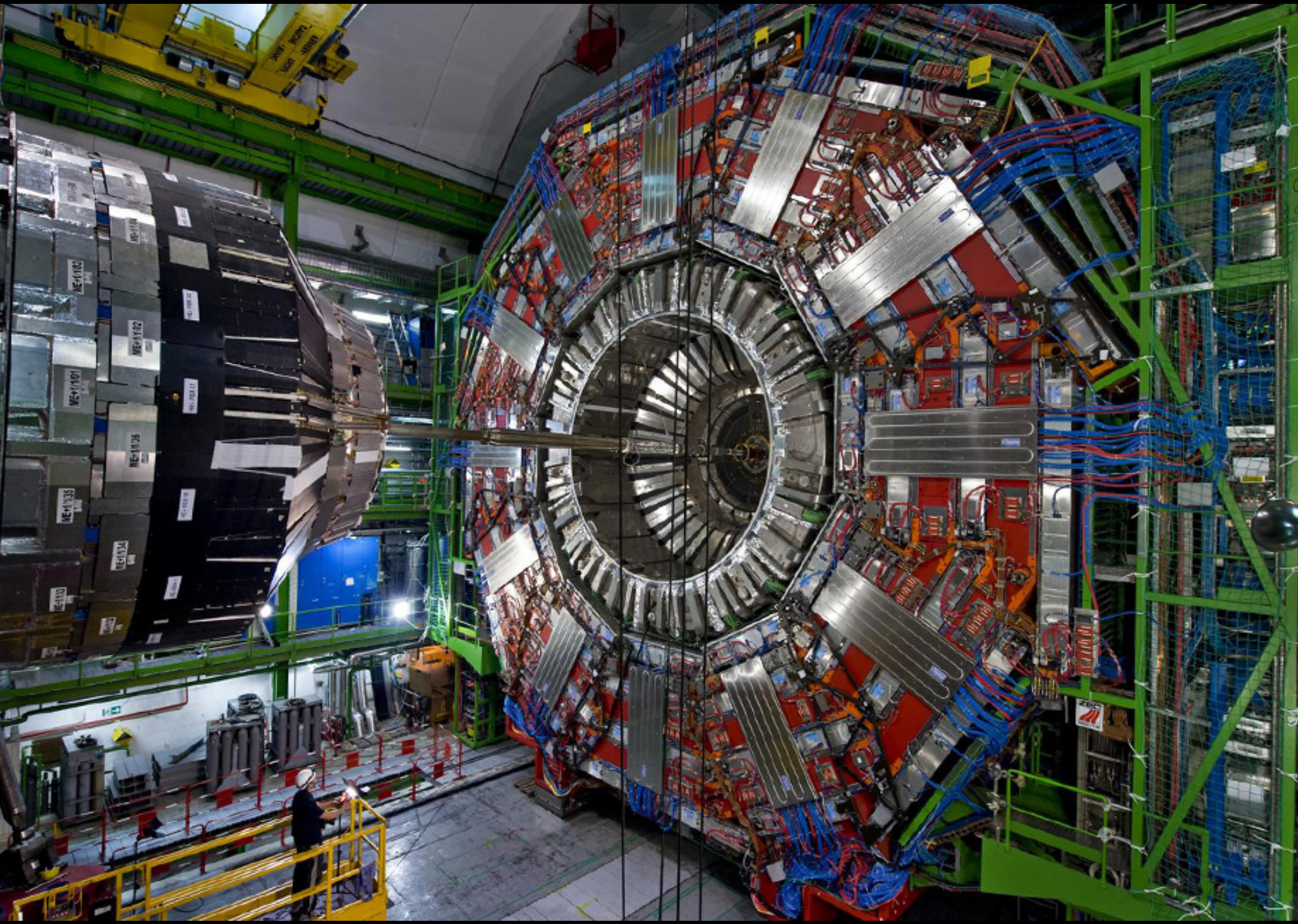
LHC Tunnel with Magnets


electromagnetic calorimeter
solenoid
muon chambers
hadronic calorimeter
inner tracker
magnet yoke
CMS

CMS Barrel Yoke

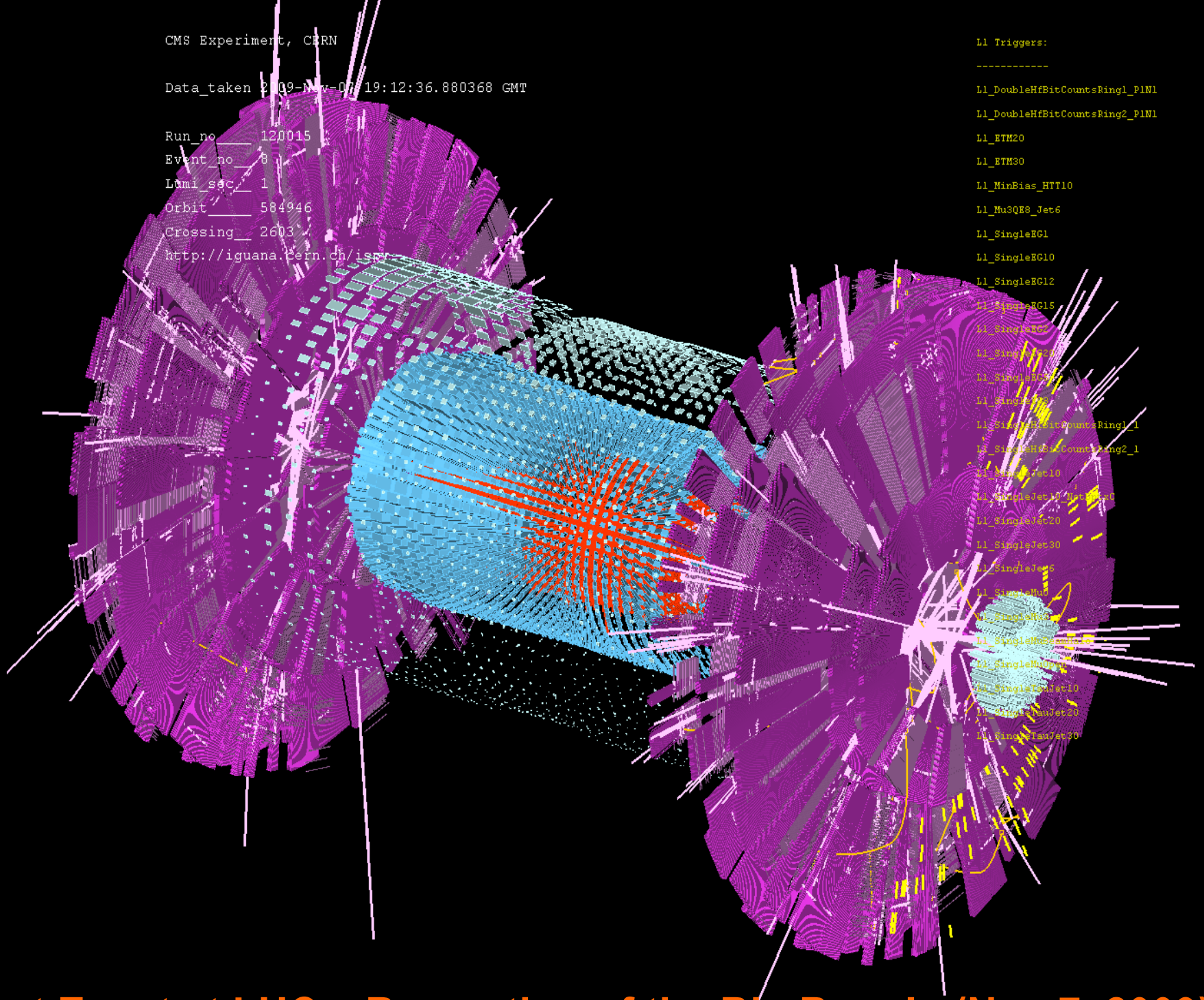

ME+2/2/03
ME+2/1/01
ME+2/2/35


VSL



Particle detectors constructed at Westwood, now at LHC, CERN

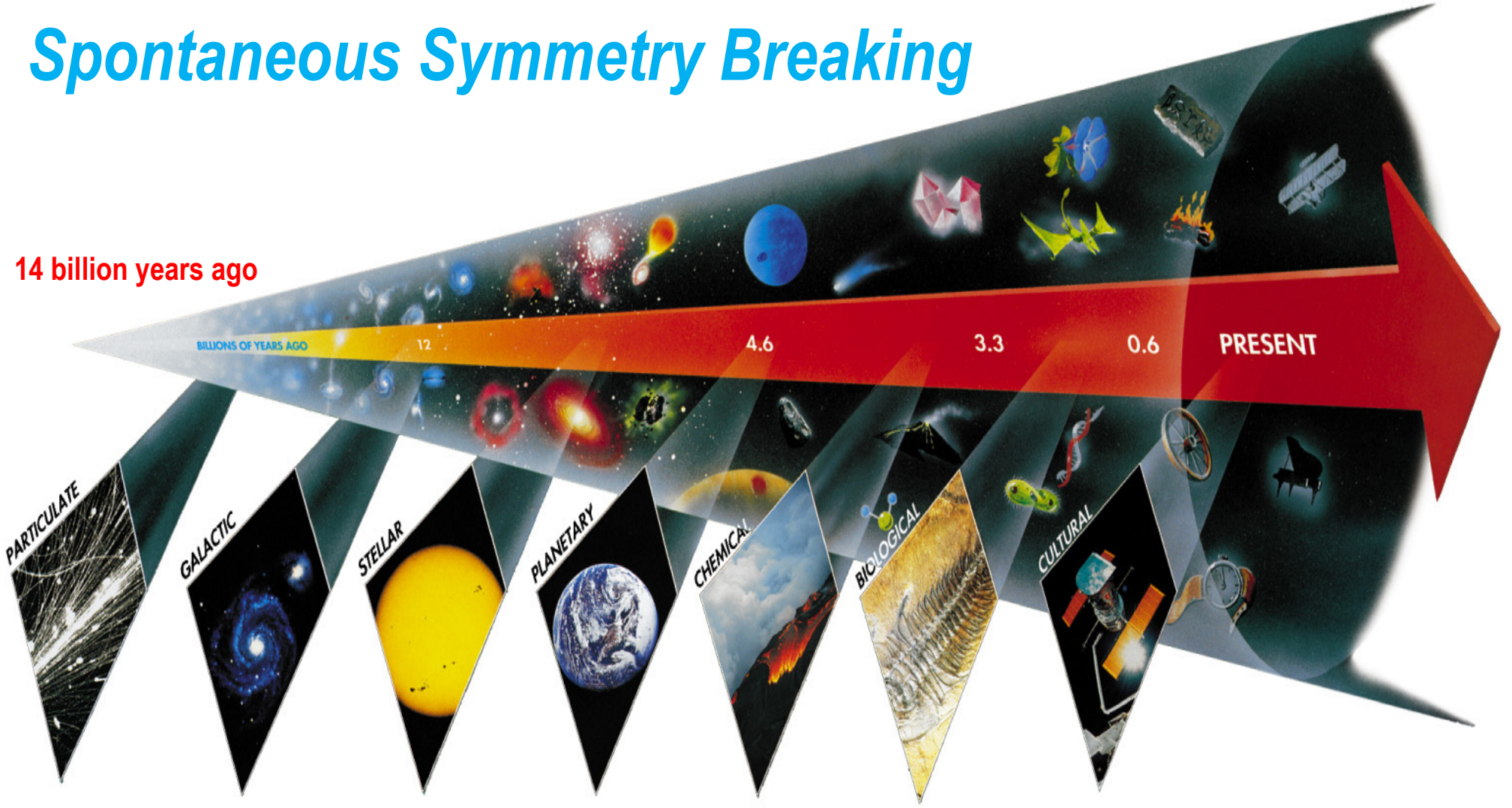
Sept 15, 2008 Issue



First Event at LHC – Recreation of the Big Bang! (Nov 7, 2009)

Seven Phases of Cosmic Evolution

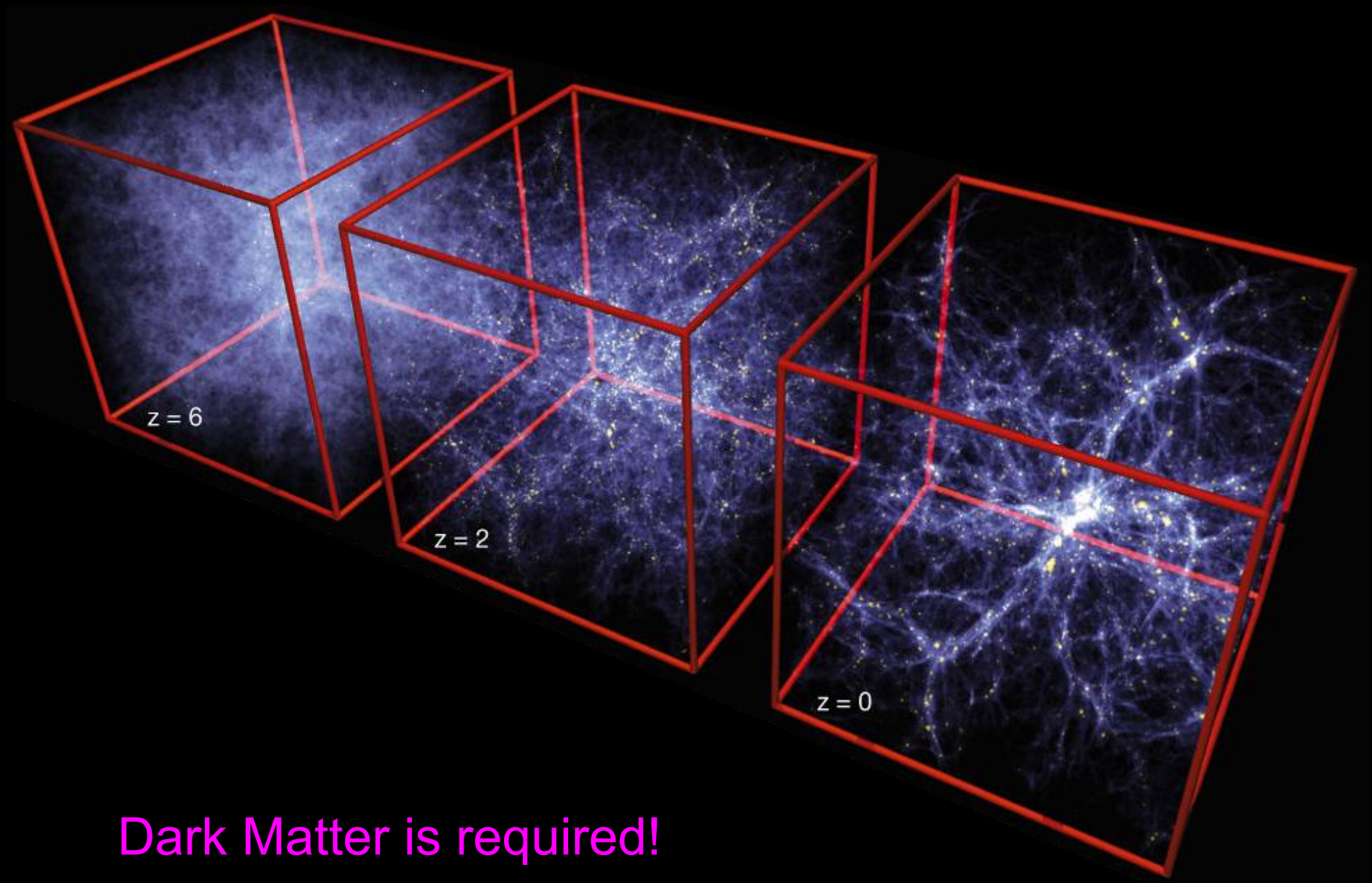
Spontaneous Symmetry Breaking



Origin of Particles

Origin of Structure

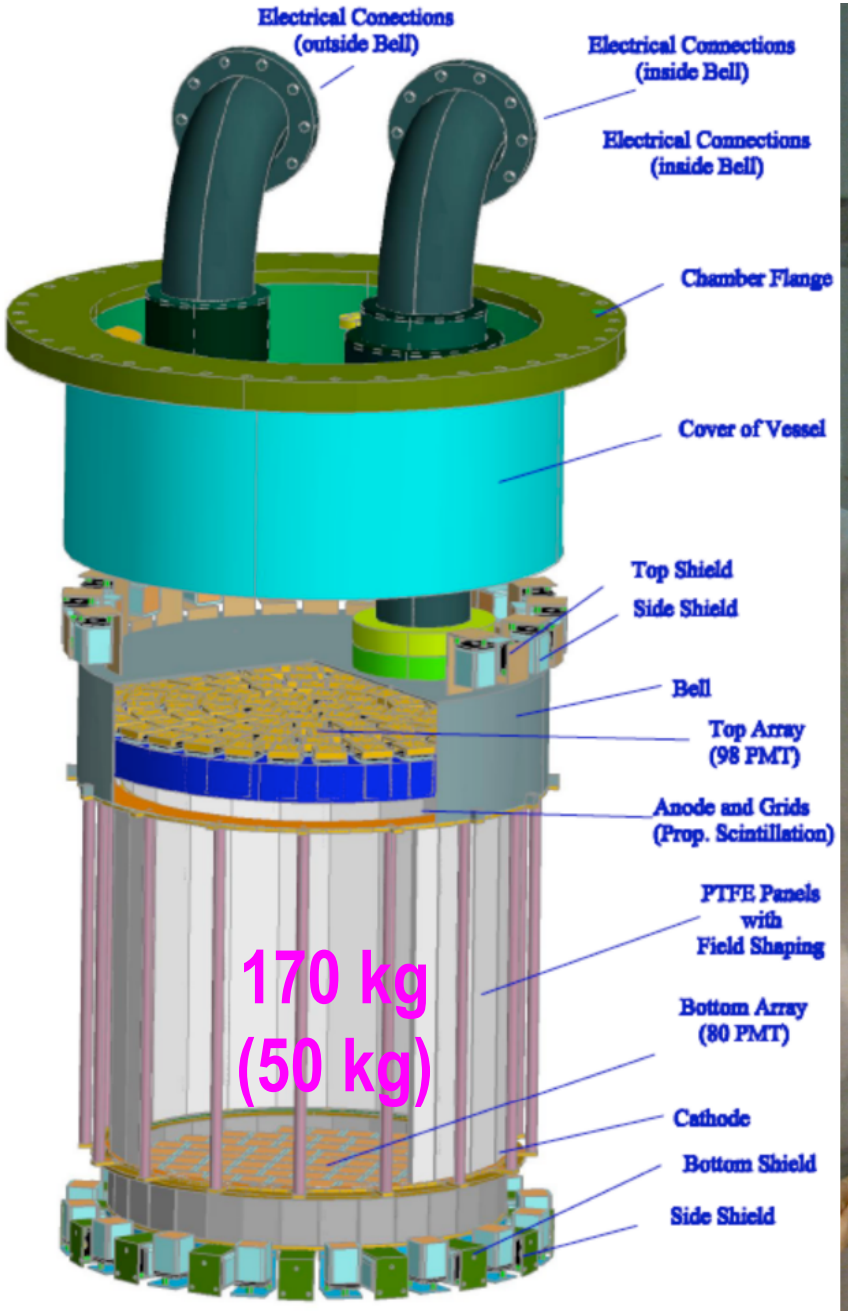
Formation of Structure in the Universe



Dark Matter is required!


Laboratori Nazionali del Gran Sasso, Italy
LNGS 1400 m Rock (3100 w.m.e)
XENON100
LVD
ICARUS
OPERA
WARP

XENON100 Detector



XENON100 Detector (2009)

Seven Phases of Cosmic Evolution

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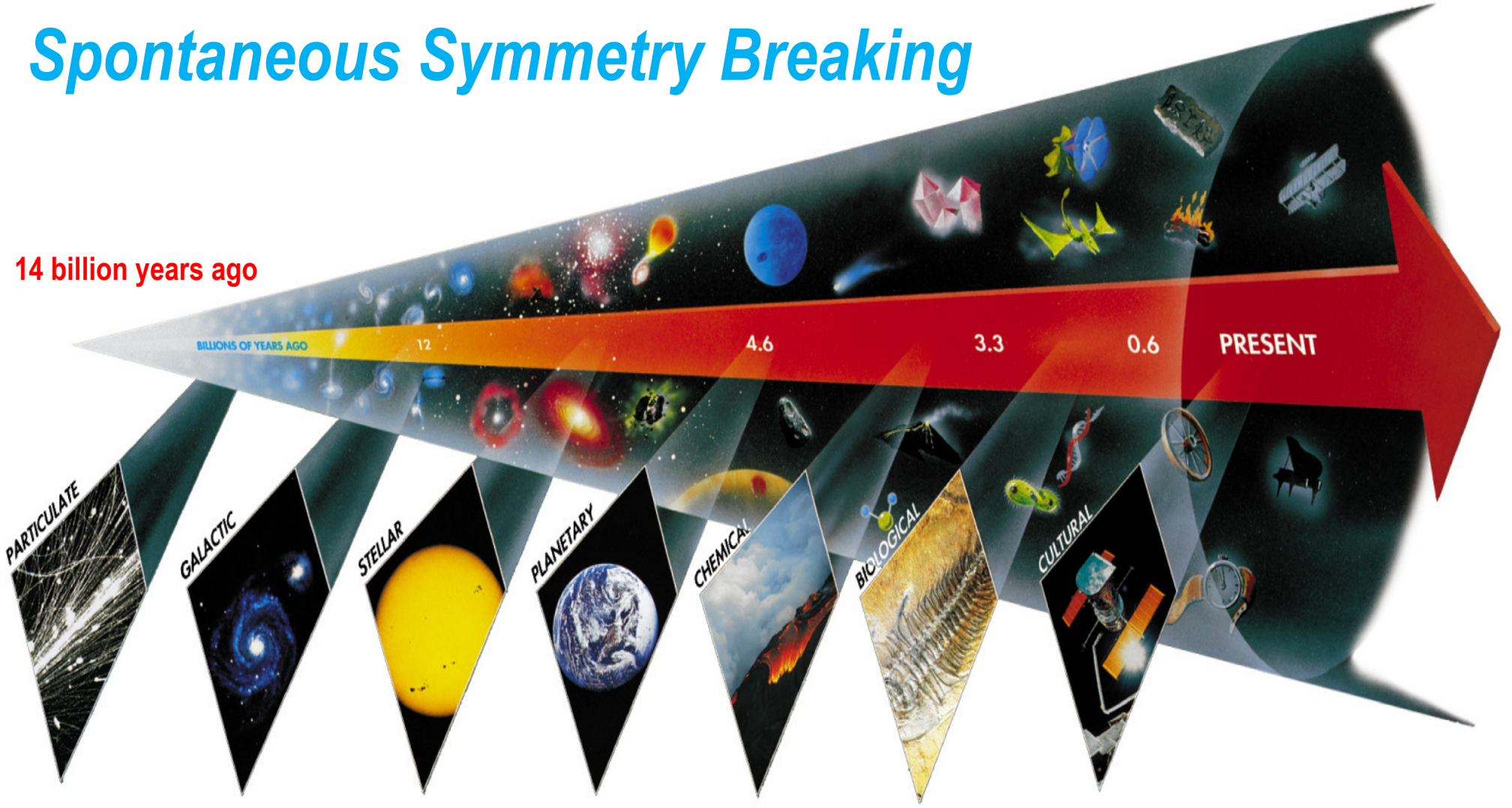
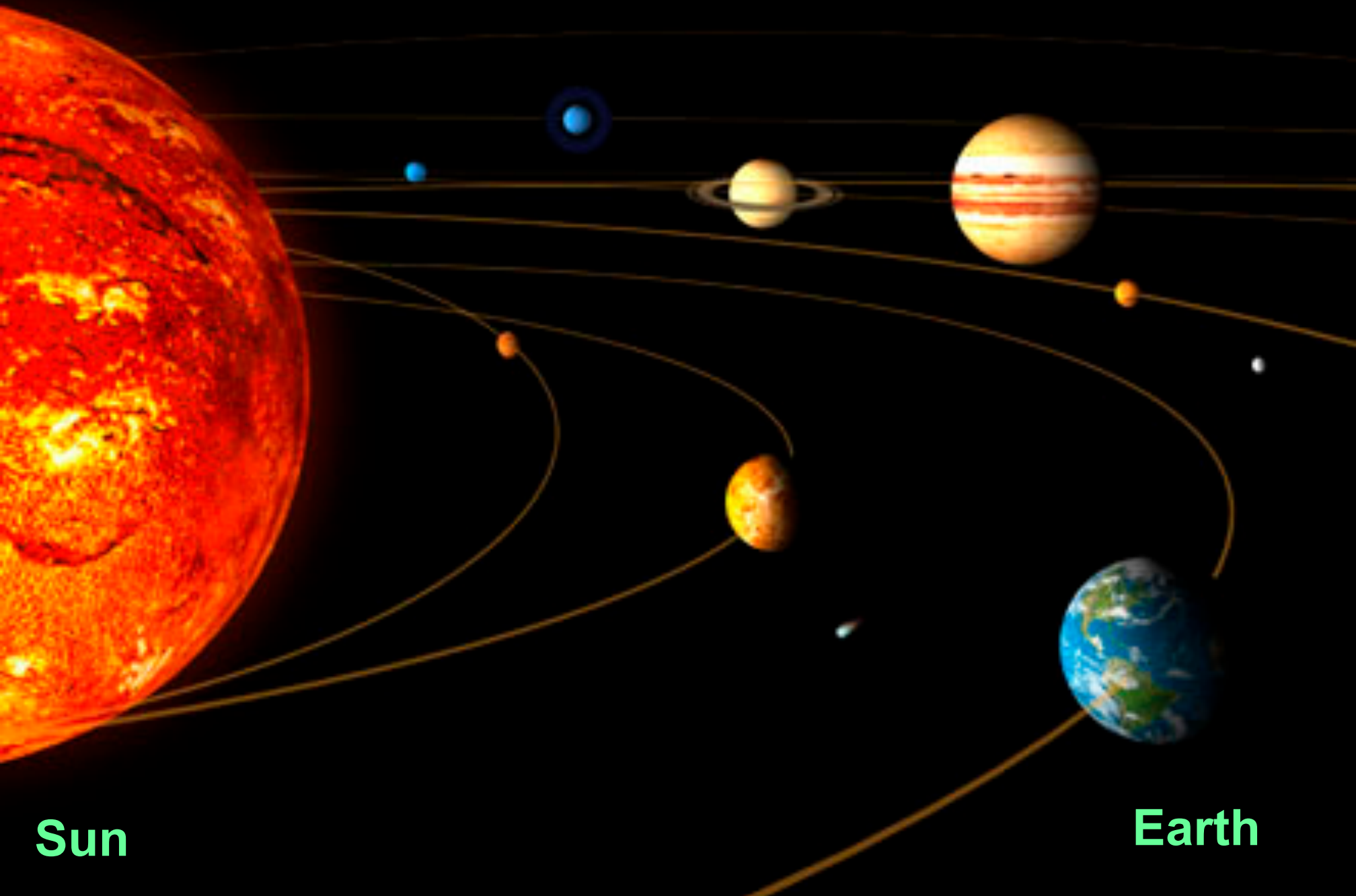


Origin of Particles

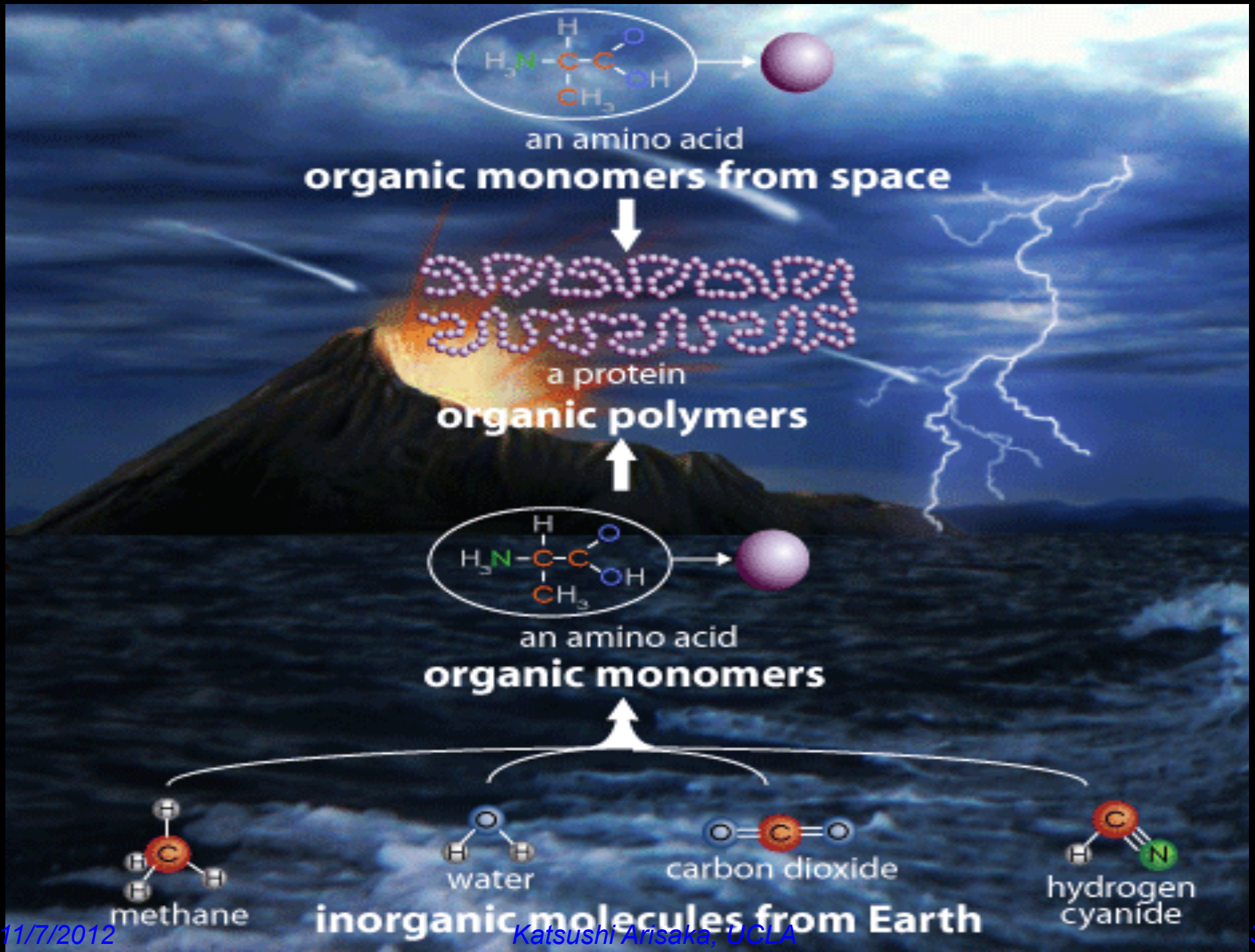
Origin of Structure

Origin of Life

Solar System (4.6 B years ago)



Organic Polymers (4.5B → 4B years)



How to observe the "Origin of Life"

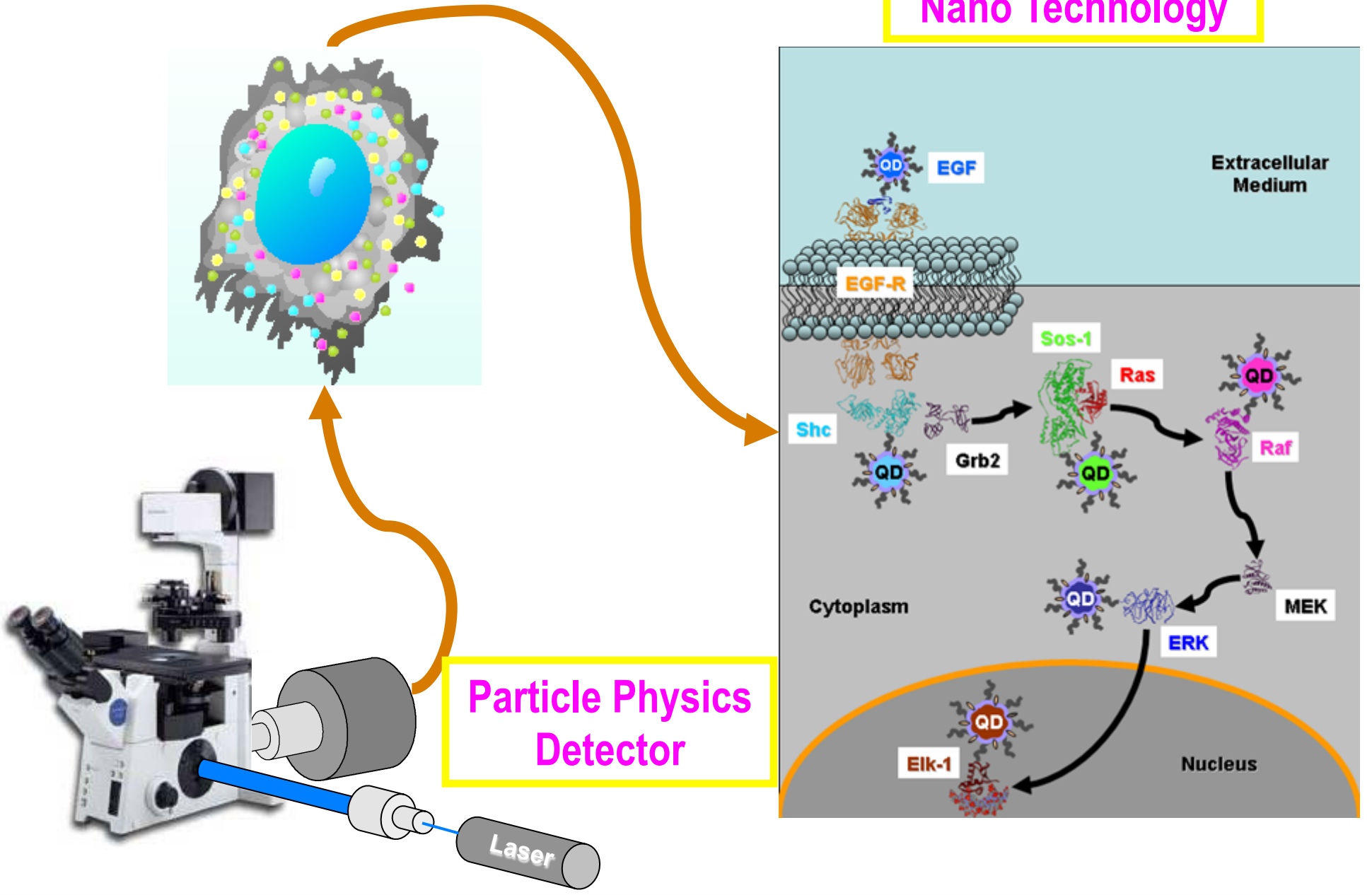
- Exactly the same way as we look for the "Origin of Universe"

  Telescope ⇔ Microscope

- We must look for "Live Life"

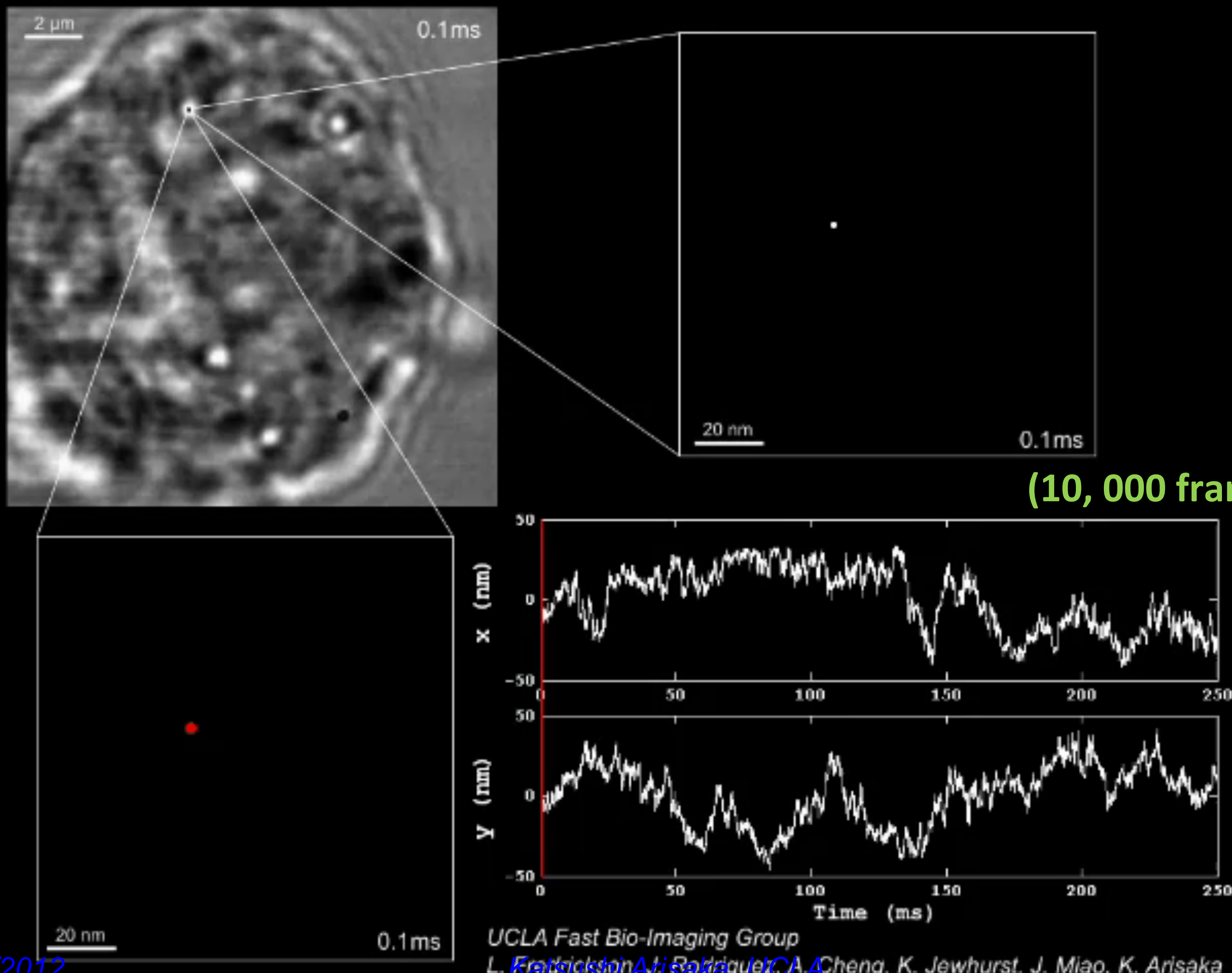
- Take advantages of the state of art "Photon Detectors" in particle physics.

Single Molecule Imaging



Gold nano particle (40nm) attached to Transferrin Receptor (TfR) on Cancer Cell

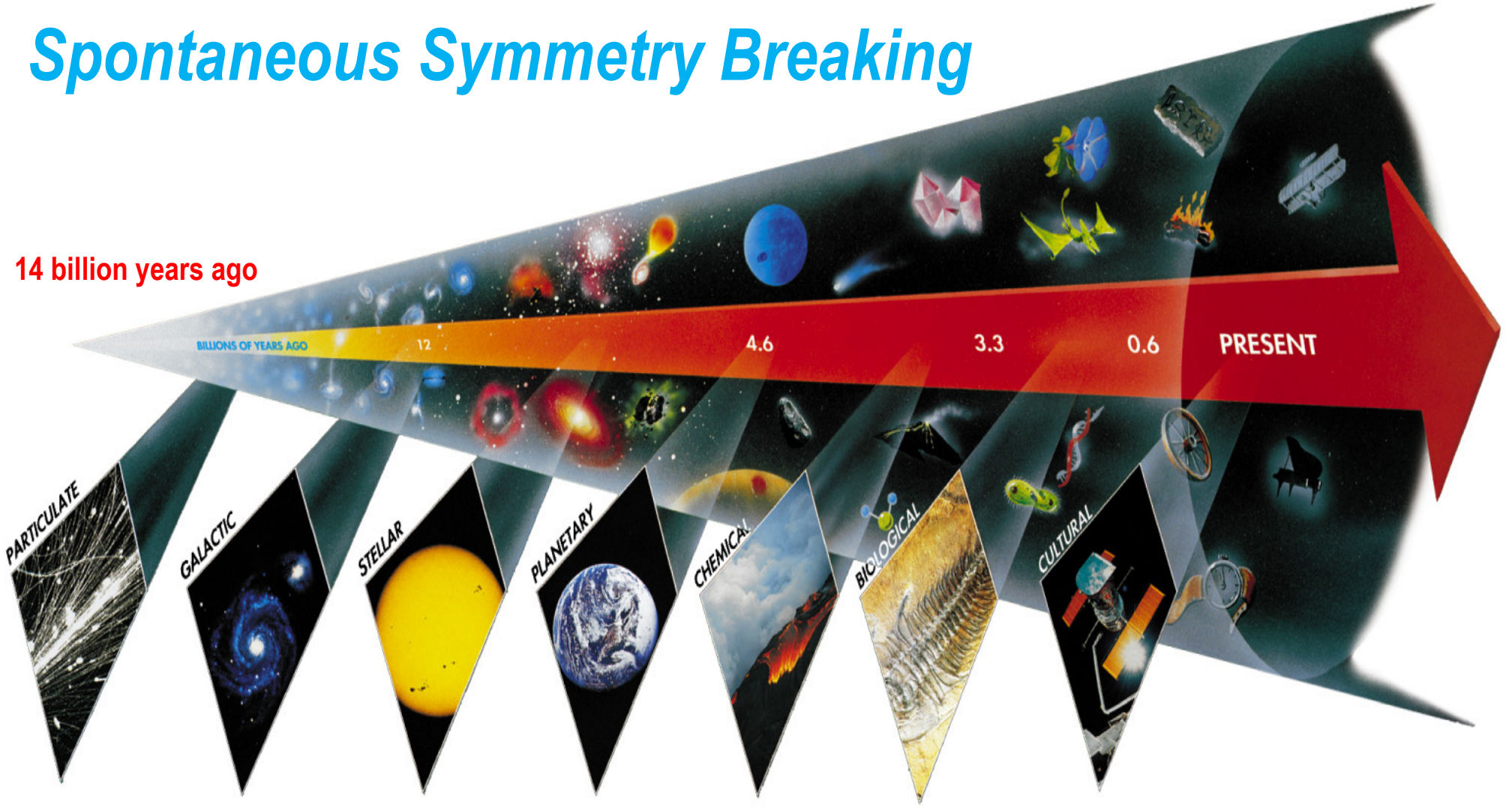
Prof. Manuel Penichet (Oncology)



(10, 000 frame/sec)

Seven Phases of Cosmic Evolution

Spontaneous Symmetry Breaking



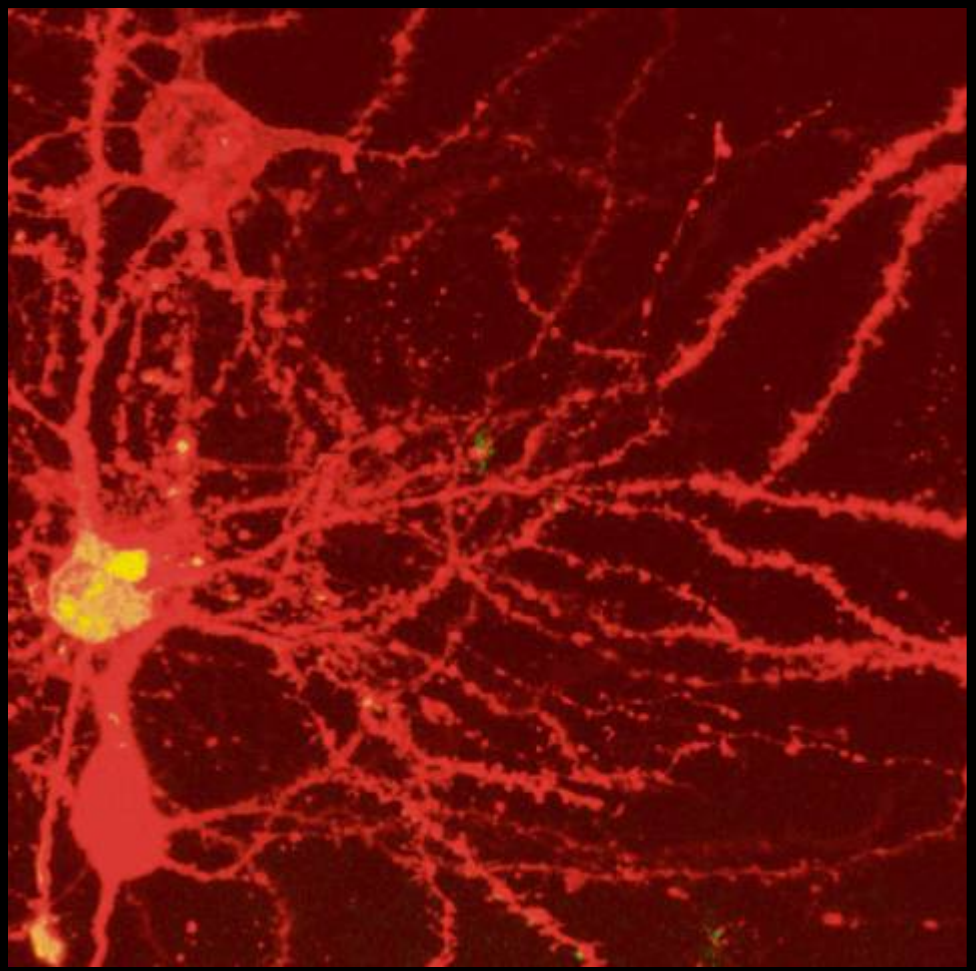
Origin of Particles

Origin of Structure

Origin of Life

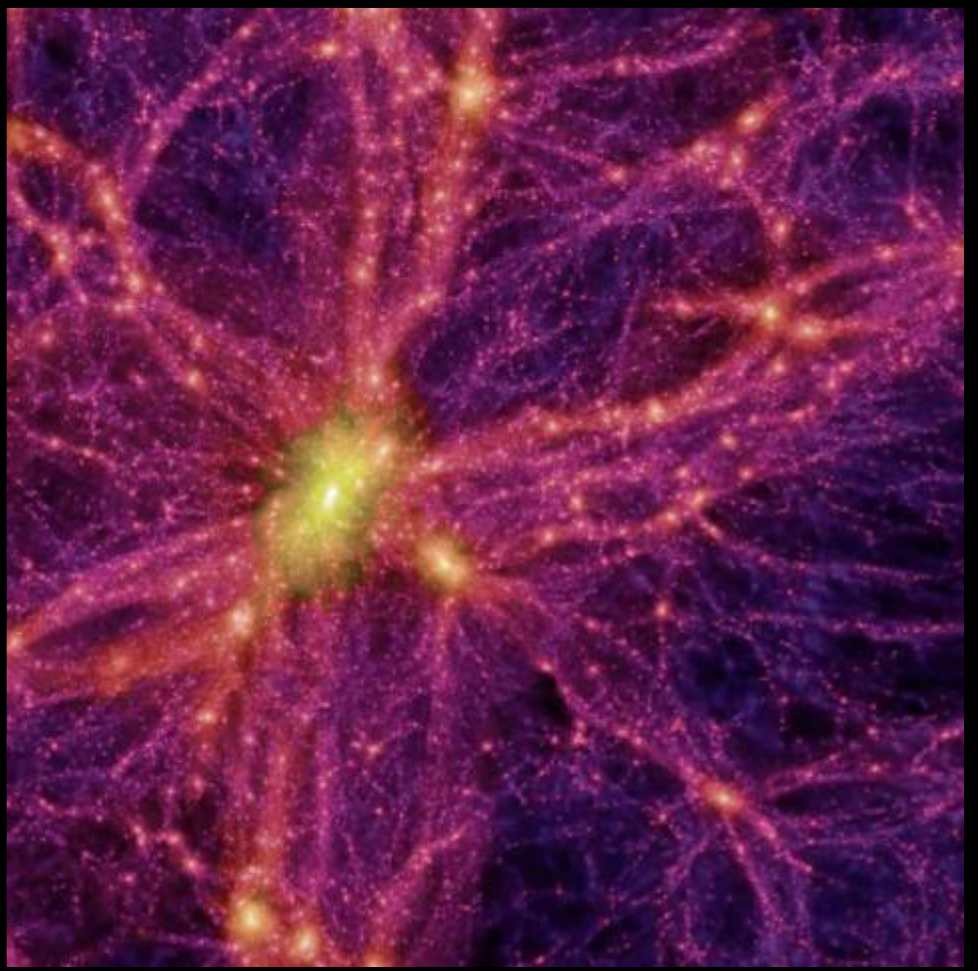
Origin of Consciousness

Brain



100 Billions Neurons

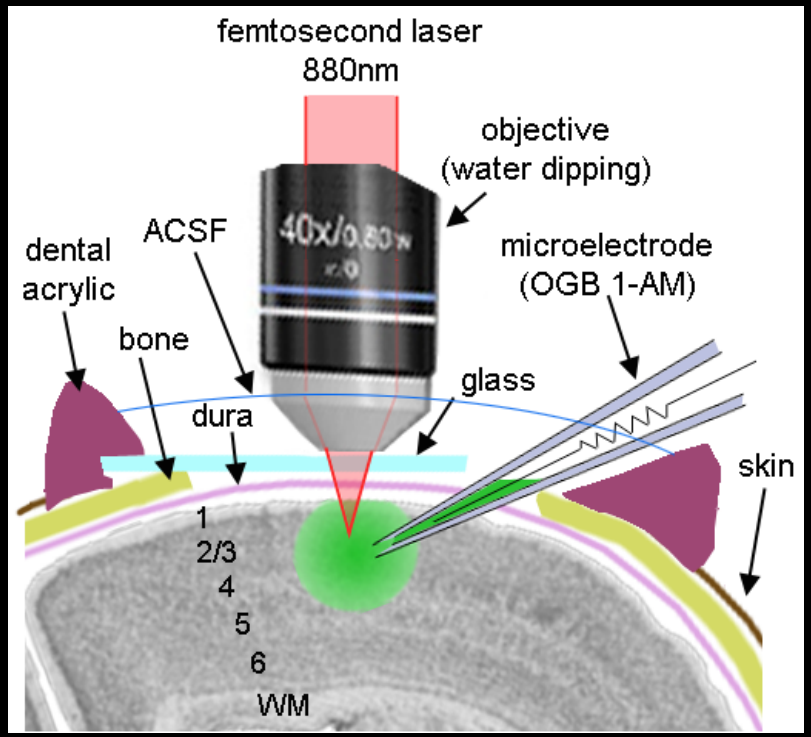
Universe

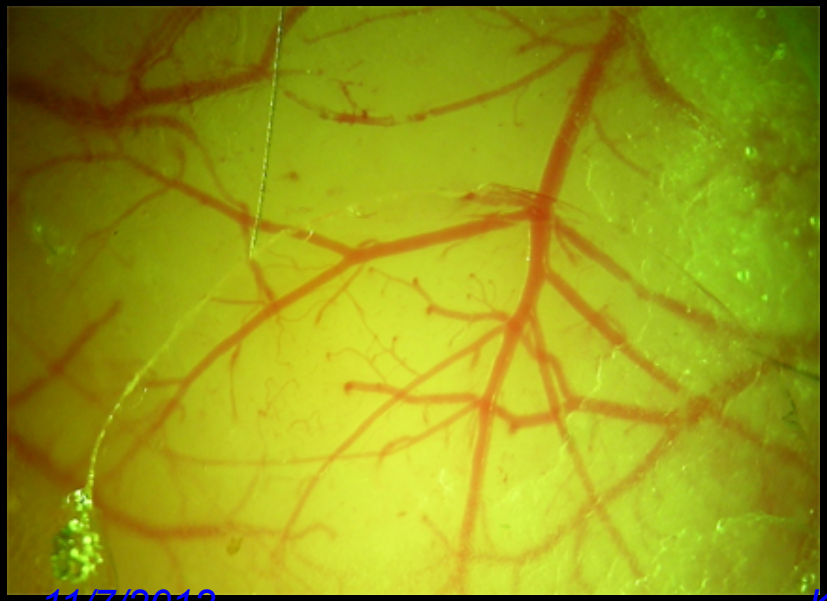


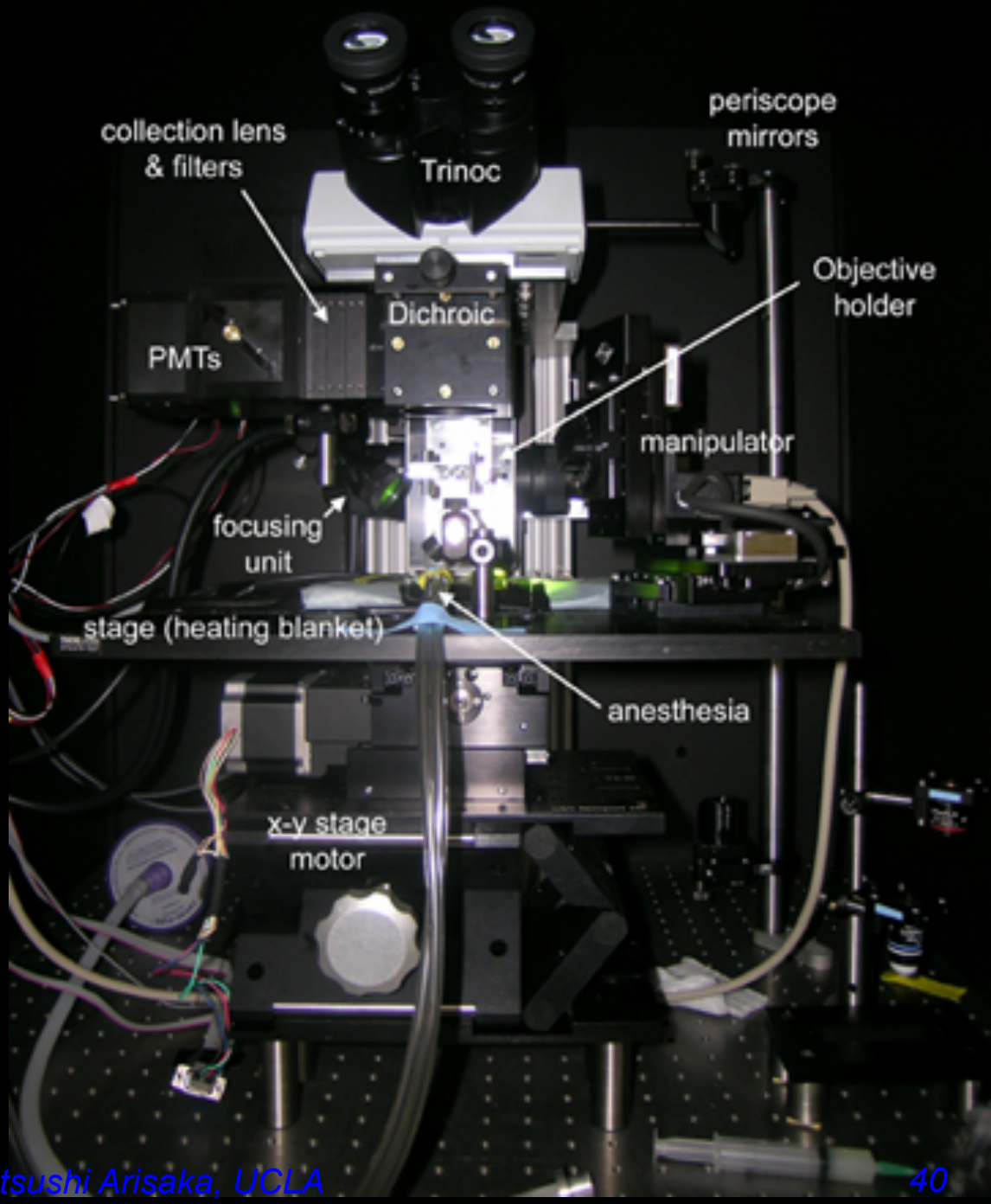
100 Billions Galaxies

New York Times 8/21/2006

In vivo calcium imaging of neuronal activity







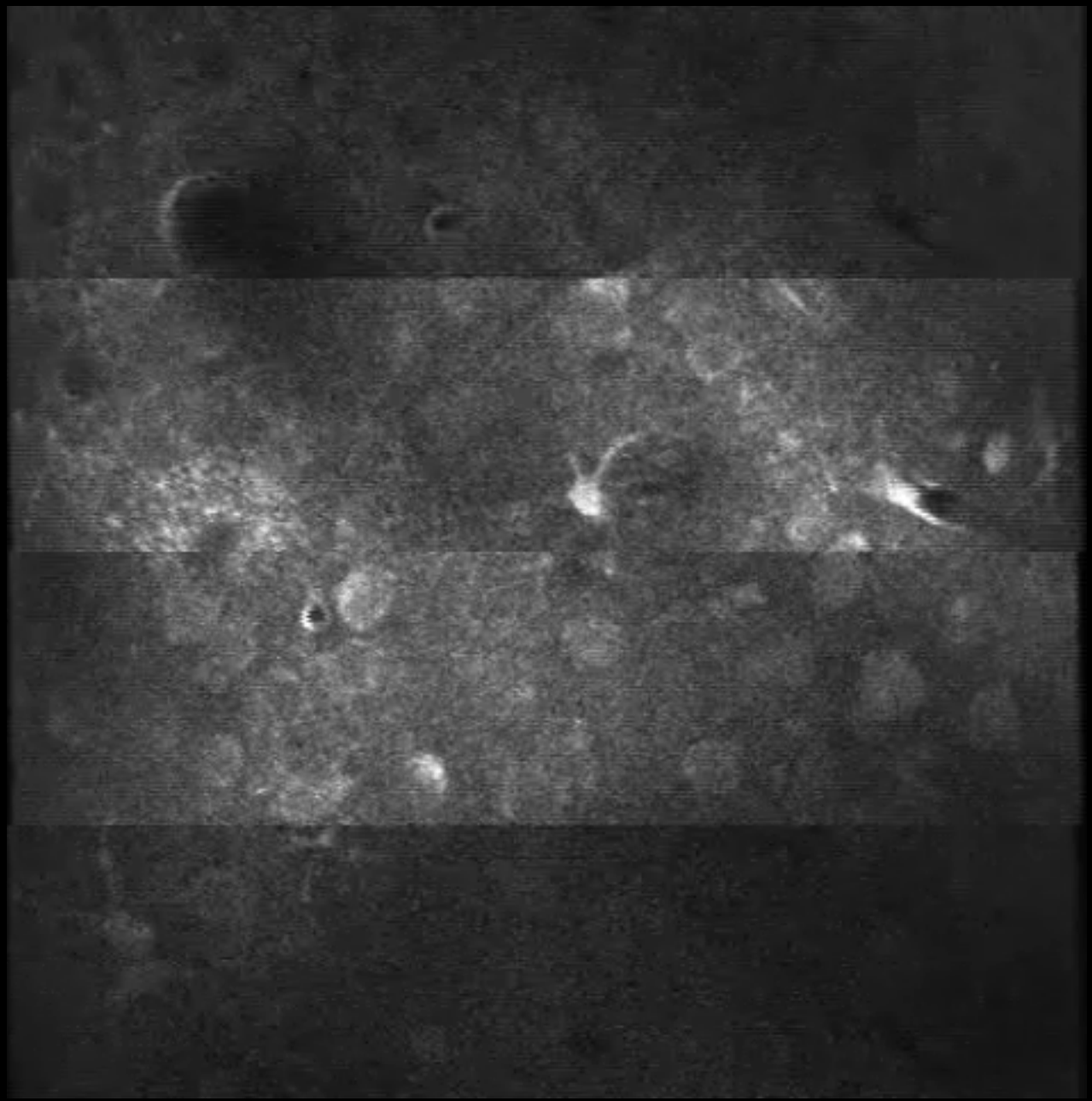
In vivo calcium imaging of Barrel Cortex of Mouse

Barrel Cortex Layer 2/3

150 μm deep

240 fps Raw Data

(x3 faster than real)



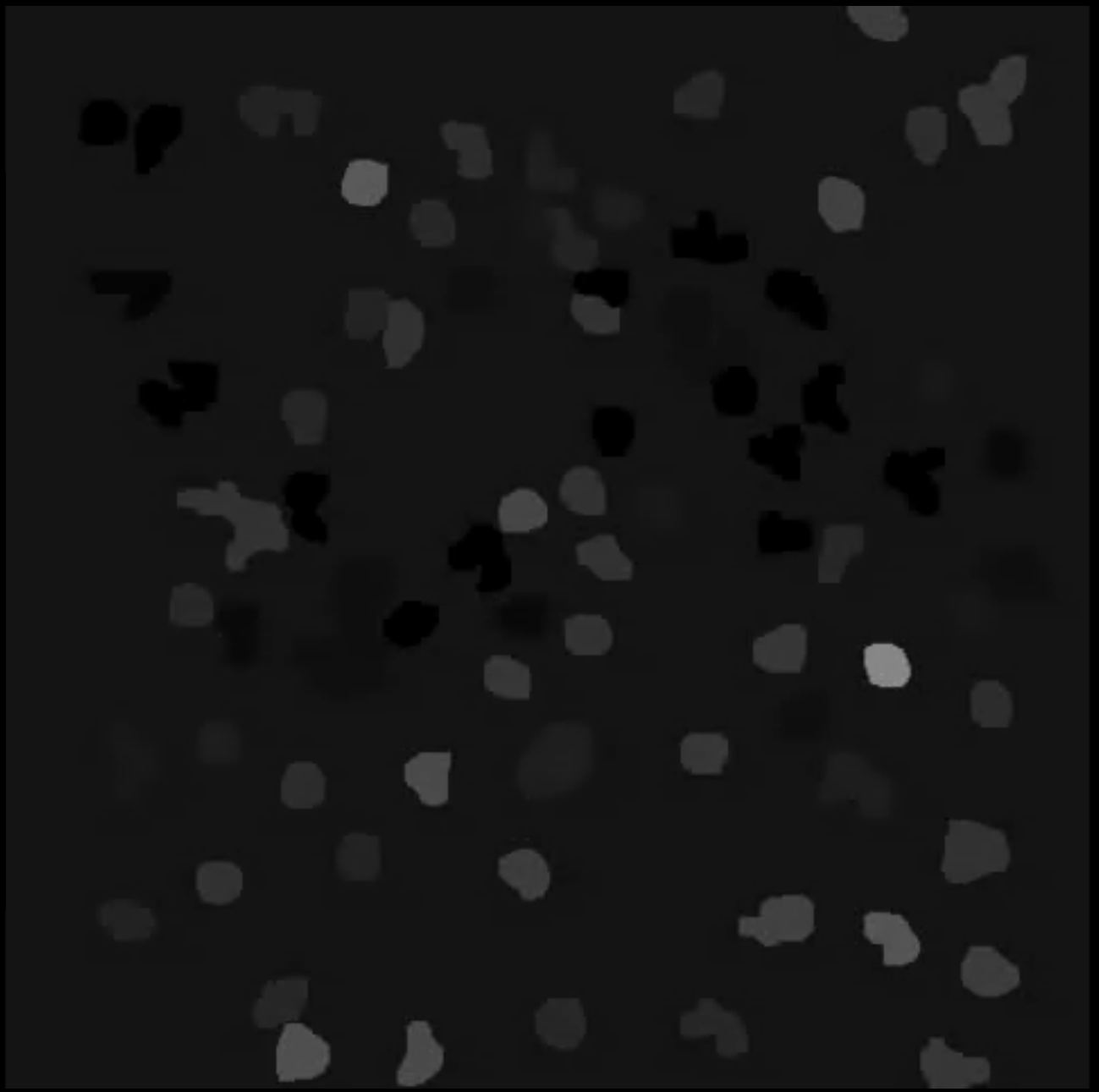
In vivo calcium imaging of Barrel Cortex of Mouse

Barrel Cortex Layer 2/3

150 μm deep

After averaging

(x3 faster than real)



58 neurons

(~100 billons neurons in our brain)

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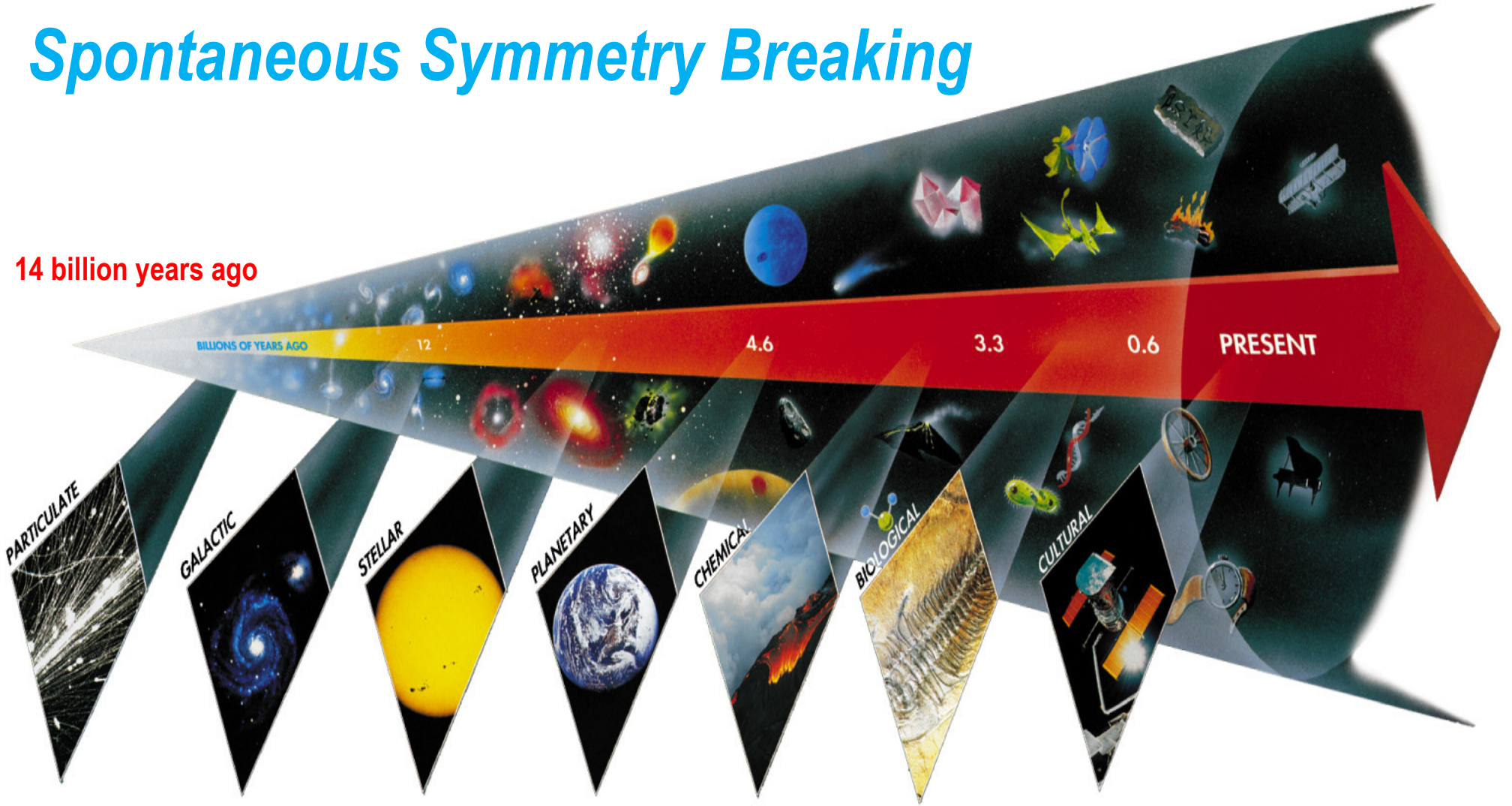
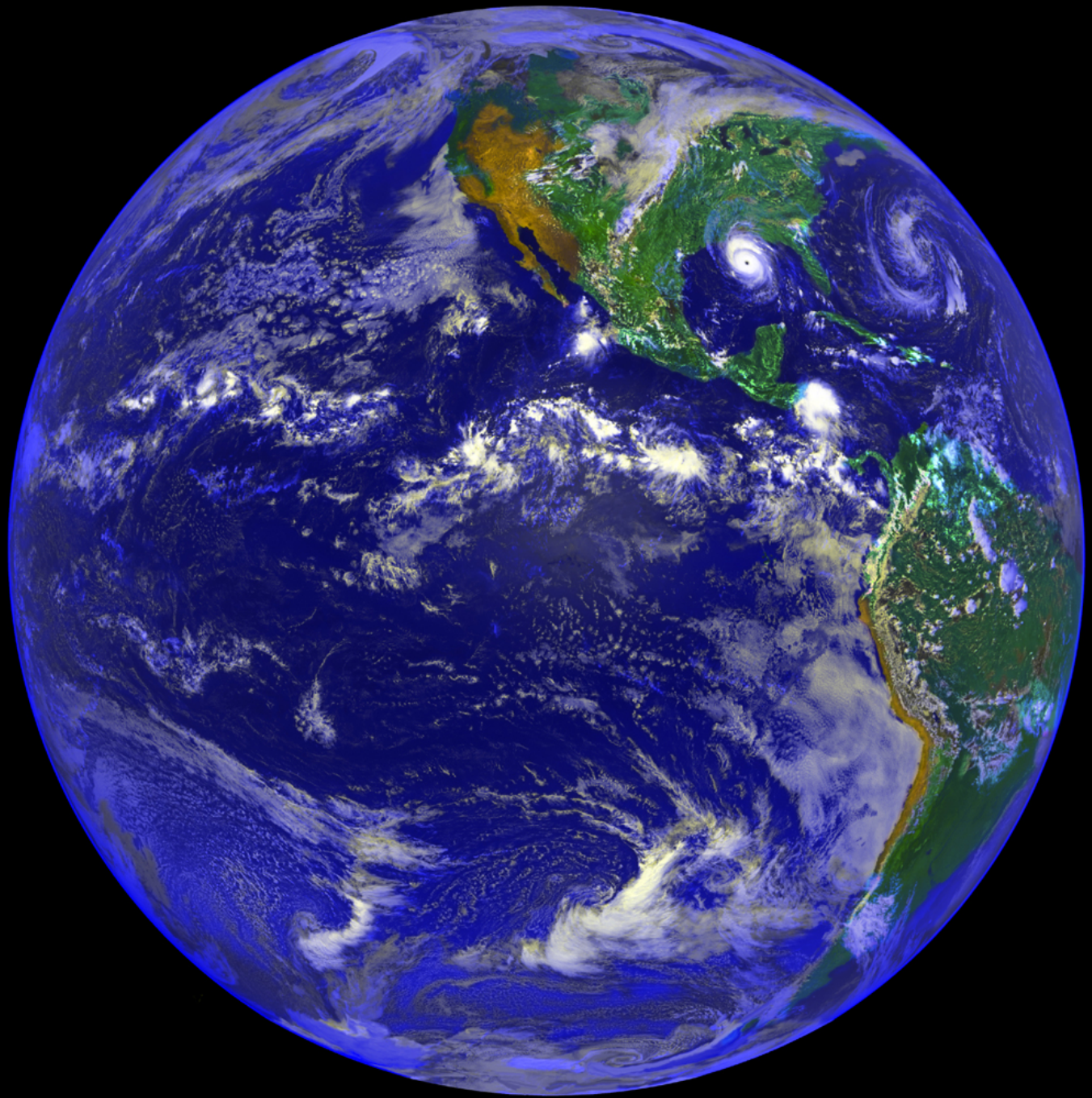


Origin of Particles

Origin of Structure

Origin of Life

Origin of Consciousness



Why are we here?


There may be ~100 Billion Universes.

Four Major Science