



Irfu

Irfu: A large institute of CEA

French Alternative Energies and Atomic Energy Commission

16 000 Employees

3 900 M€ Budget

Energies



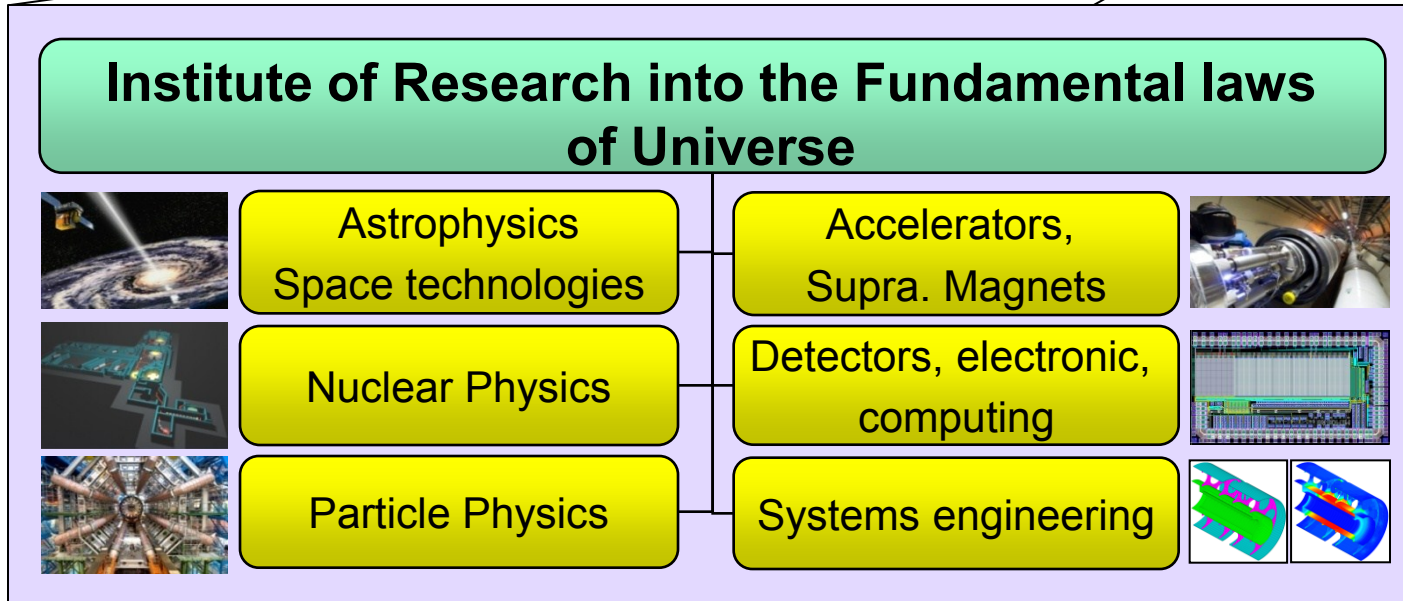
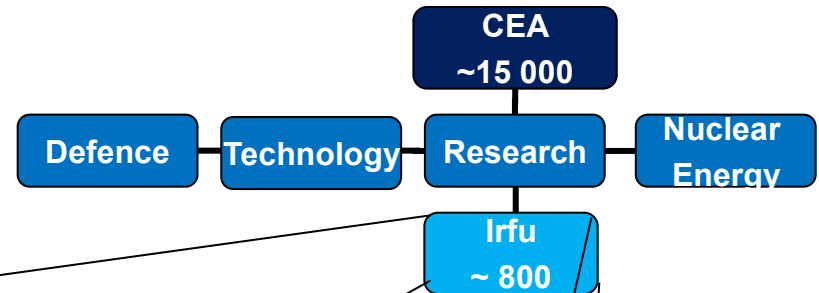
**Defense and
Security**

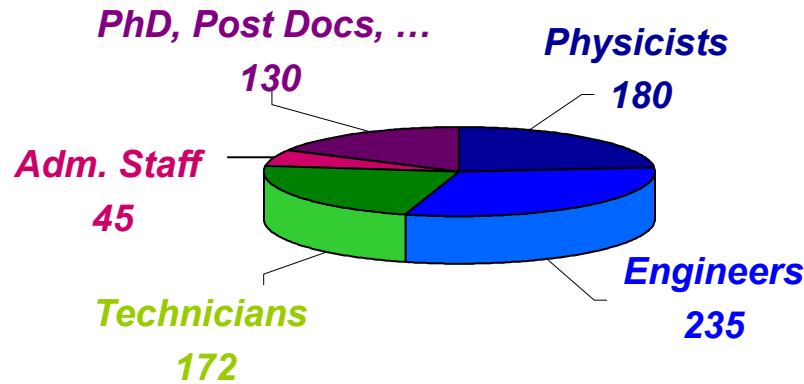


Technologies for Information and Health

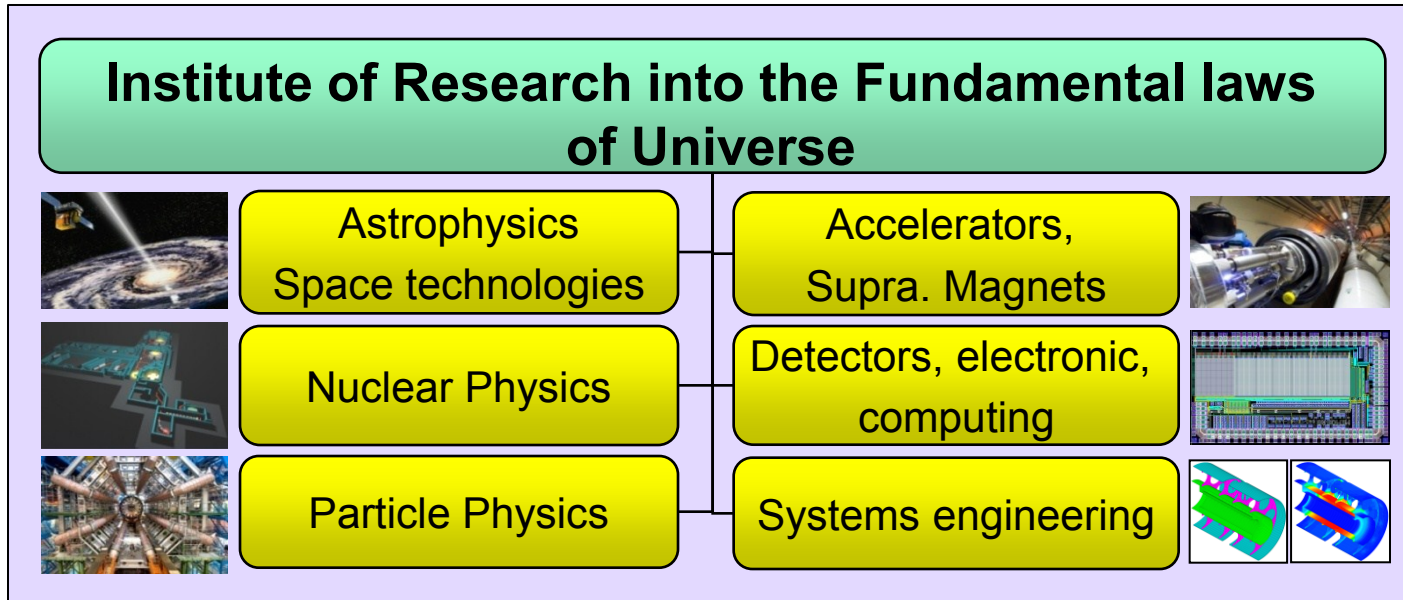
Basic Research







Research and technology



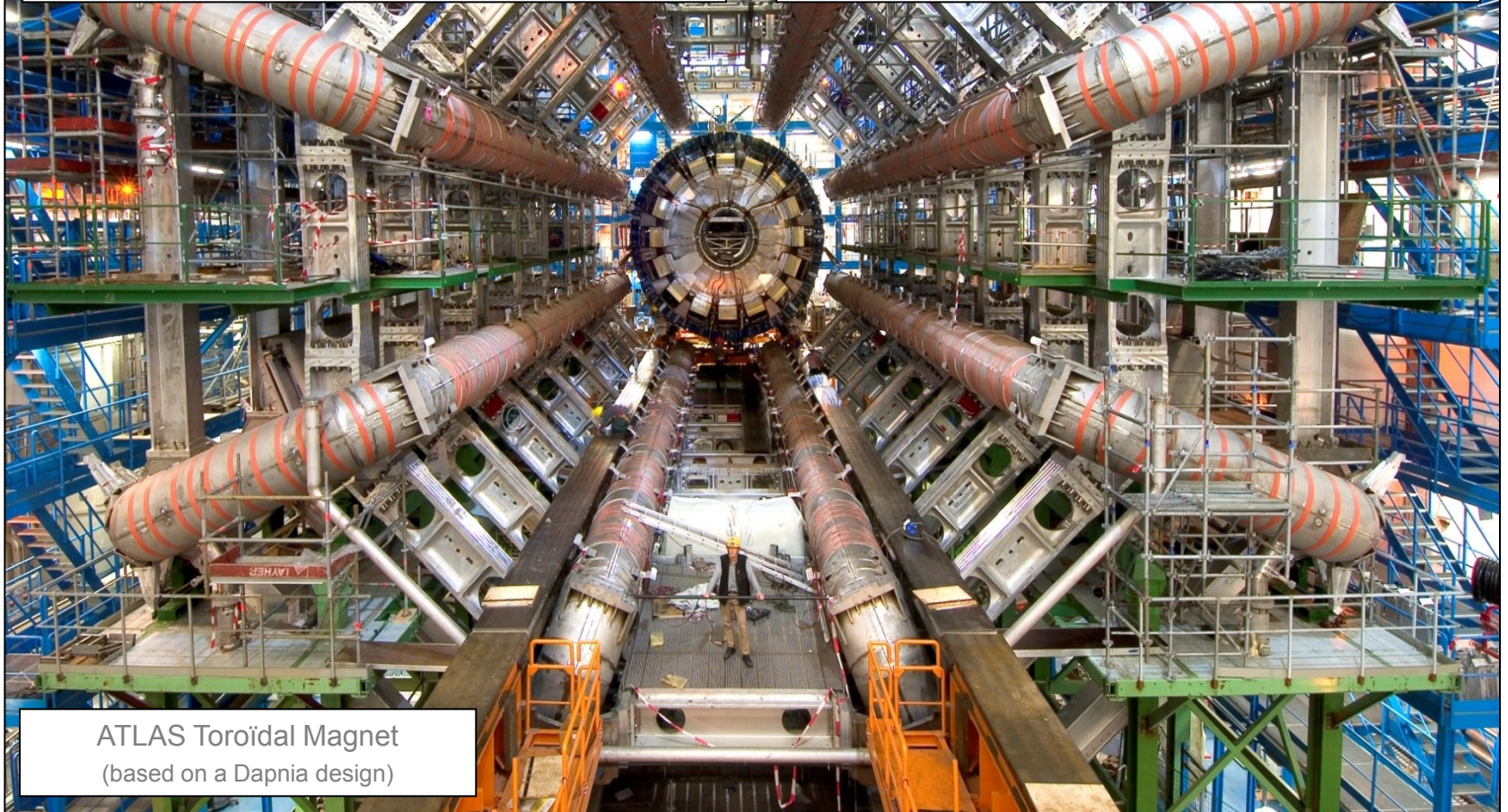


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Institute of research into the fundamental laws of the universe

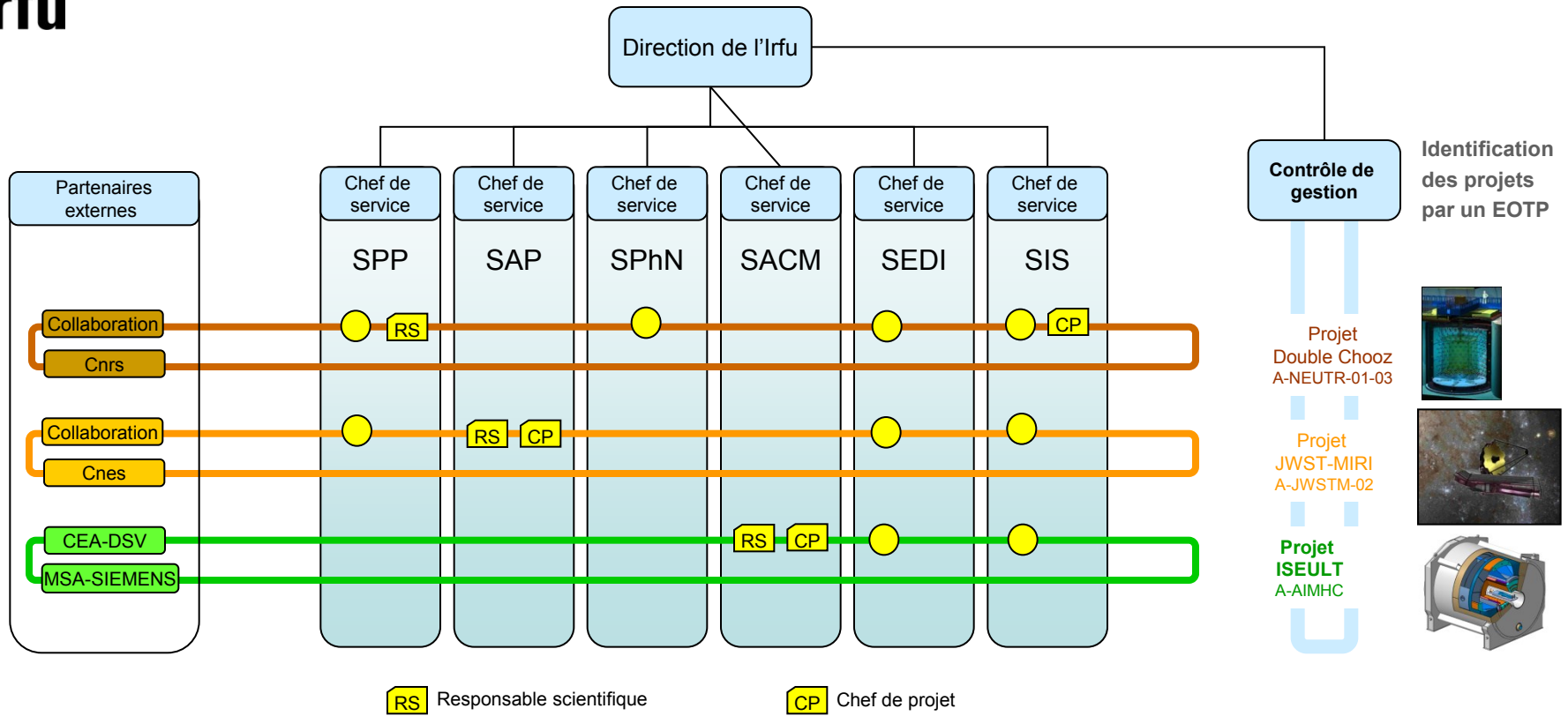
Concentration of human Resources
Heavy equipment
Advanced technologies

Project oriented organization,
inside CEA, a technology
dominated institution



ATLAS Toroidal Magnet
(based on a Dapnia design)





Services: Manage Human resources, competences, Technological platforms

Projets: Deliver instruments respecting performances/cost/schedule

Direction: Provide resources, manage risks, make decisions



Think global...

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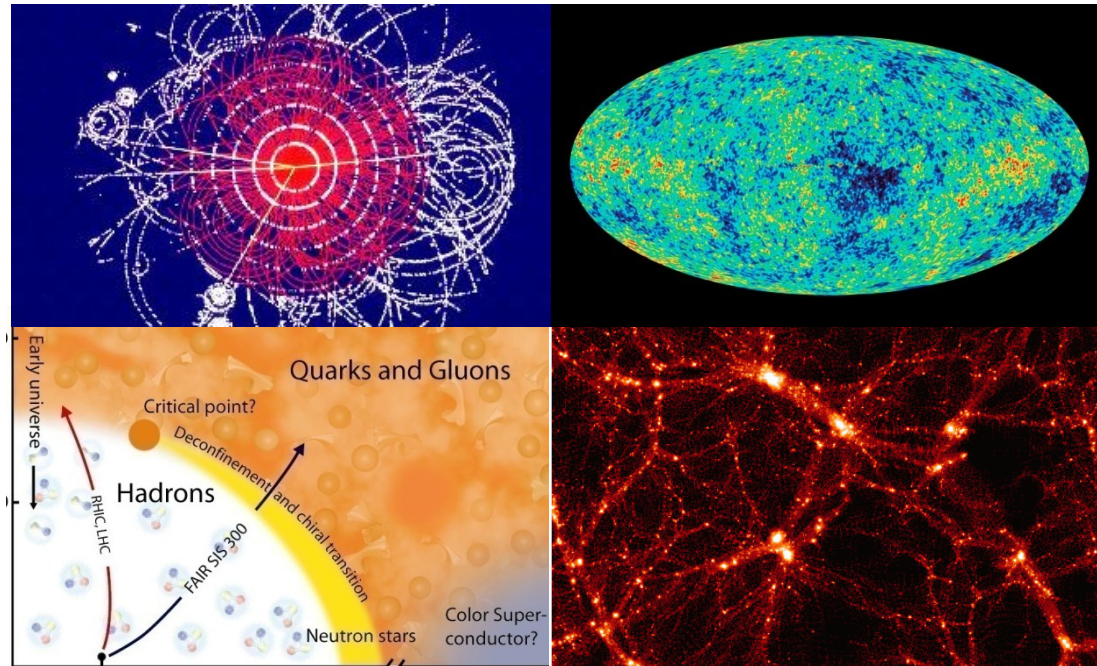
Research projects inside large international programs
implying a collaboration with other French and foreign institutions



CEA - Irfu:4 fundamental questions

What are the ultimate constituents of matter ?

What is the energy content of the Universe ?



What are the origins of particles and nuclei ?

What are the origin and structure of Universe ?



I. Discovering the fundamental laws of Universe

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1. Elementary constituents?

- Standard Model, Higgs boson (D0, ATLAS, CMS)
- Neutrinos oscillations (T2K, Double-Chooz)

2. Energy content?

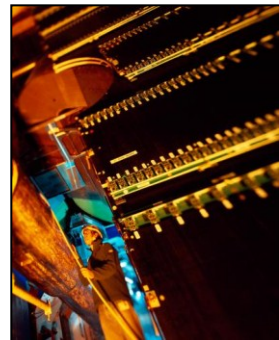
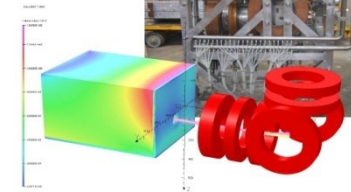
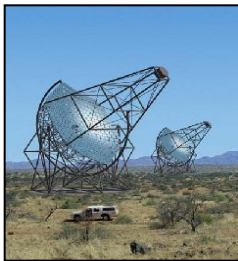
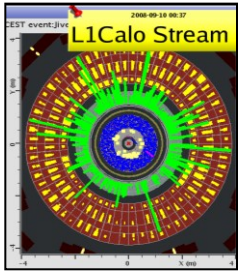
- Dark Universe (Edelweiss, bao, Euclid ...)
- Antimatter (Sophy)

3. Structures in the Universe?

- Cosmology (Planck)
- Formation of galaxies and stars (Herschel, JWST ...)
- Cosmic radiations (Fermi, SVOM, HESS, Antares)

4. Origin of particles and nuclei?

- Plasma of quarks and gluons (ALICE)
- Structure of Hadrons (COMPASS, JLAB)
- Exotic nuclei (GANIL/SPIRAL2, FAIR)

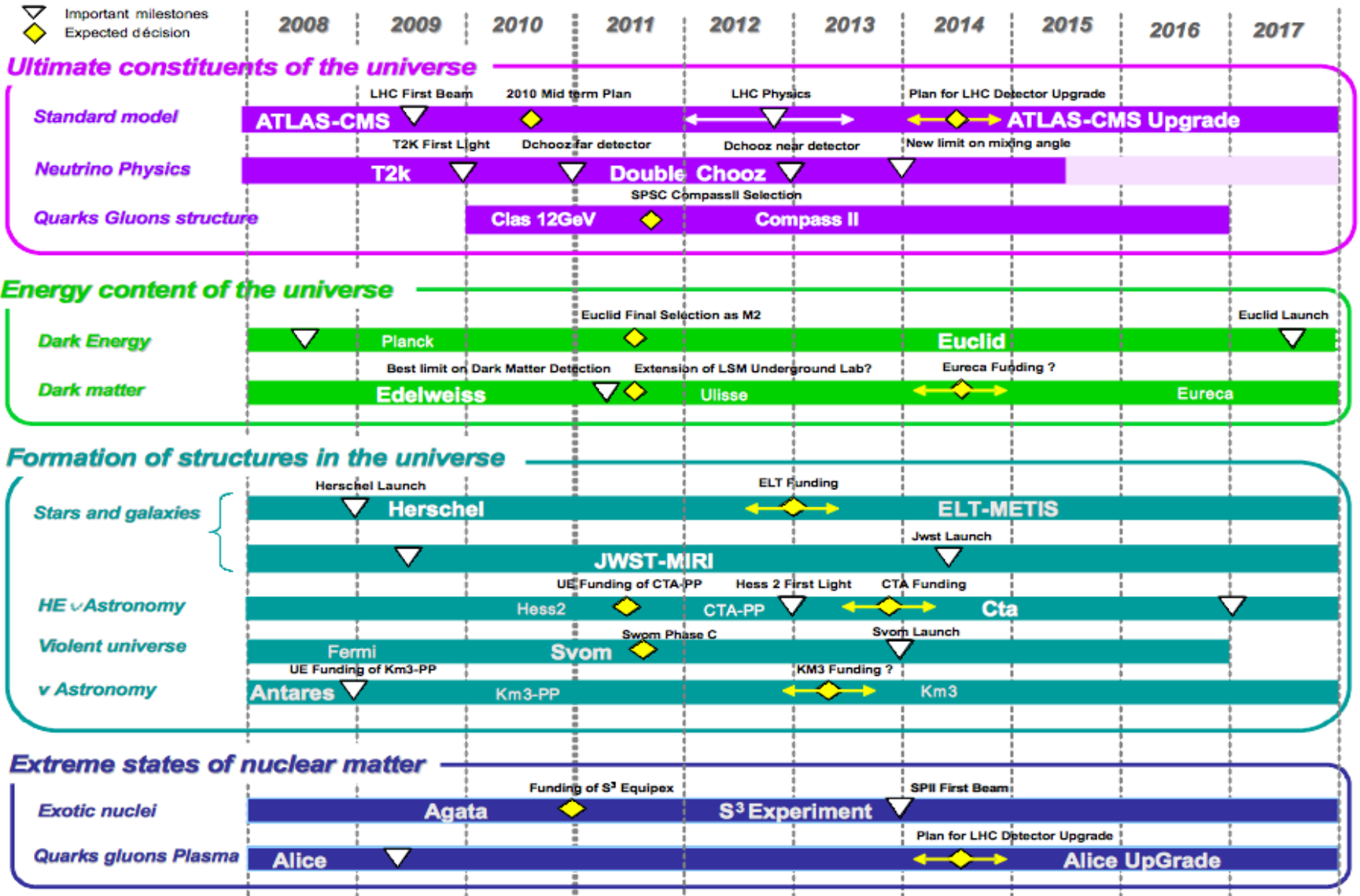




Road map for large projects @ Irfu

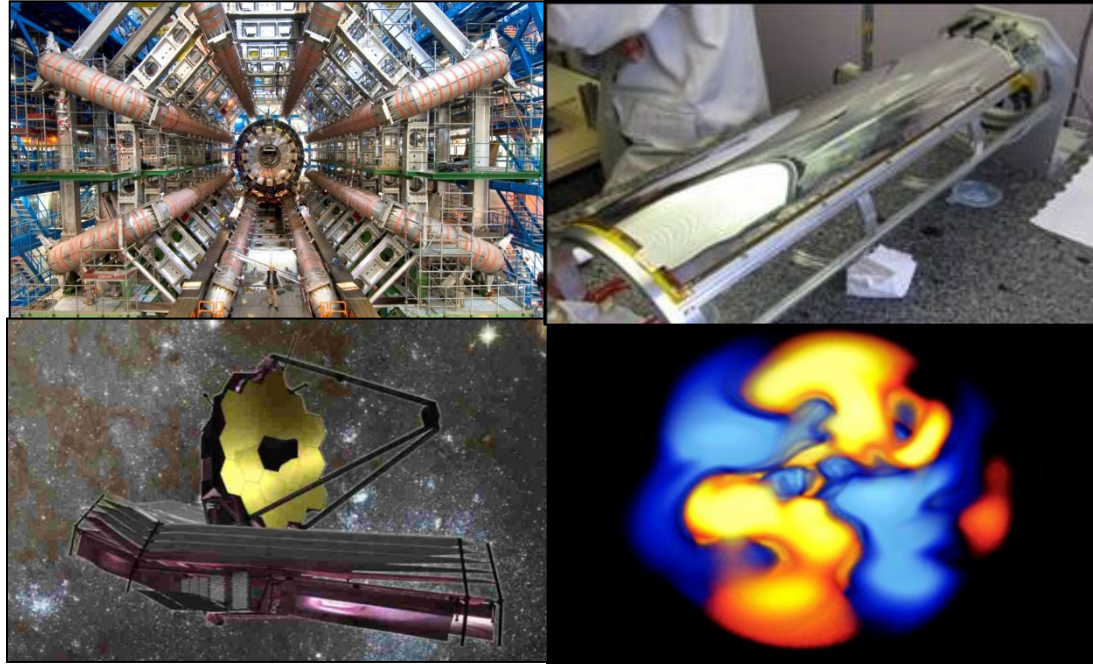
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▽ Important milestones
◆ Expected decision



Manipulating

Detecting



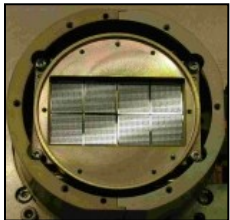
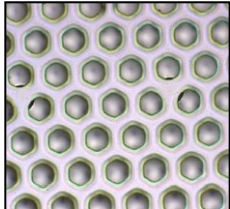
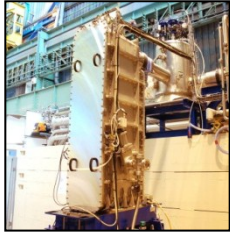
Observing

Simulating



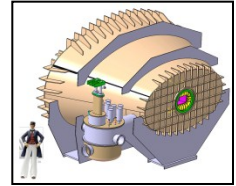
II. Inventing and constructing new devices

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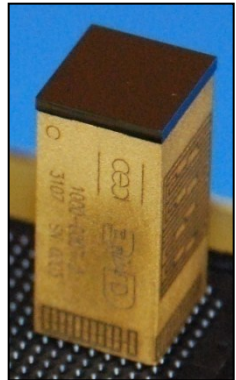
1. Production and manipulation of radiations

- Accelerators (Spiral2, XFeL, FAIR, CERN, IFMIF, ESS)
- Magnets and Superconductivity (R3B, ISEULT)



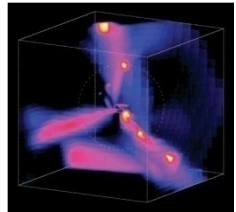
2. Detecting radiation

- Microstructured detectors (RD51, CLAS12)
- Imaging device (ELT-METIS, APEX, CALIST)
- ASIC



3. Space technology

- Camera (PACS, MIRI, Éclair)
- Data center (Fermi, SWOM)



4. Simulation and data treatment

- Massively parallel calculations
- Grid
- Data processing



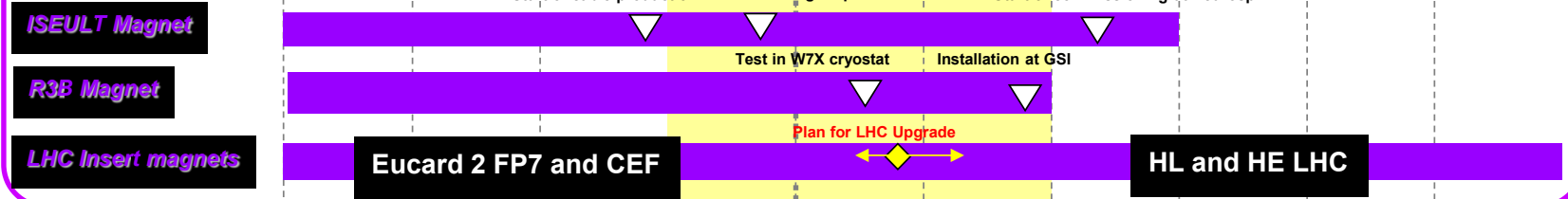
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Road map for cryotechnologies @ Irfu

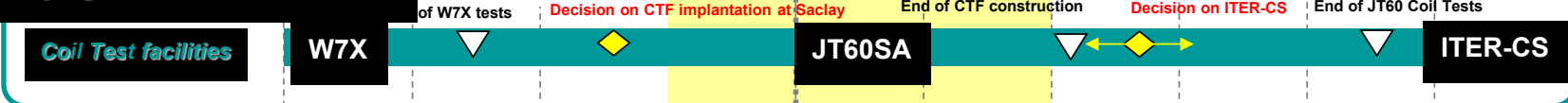
▽ Important milestones
◆ Expected decision

2008 2009 2010 2011 2012 2013 2014 2015 2016 2017

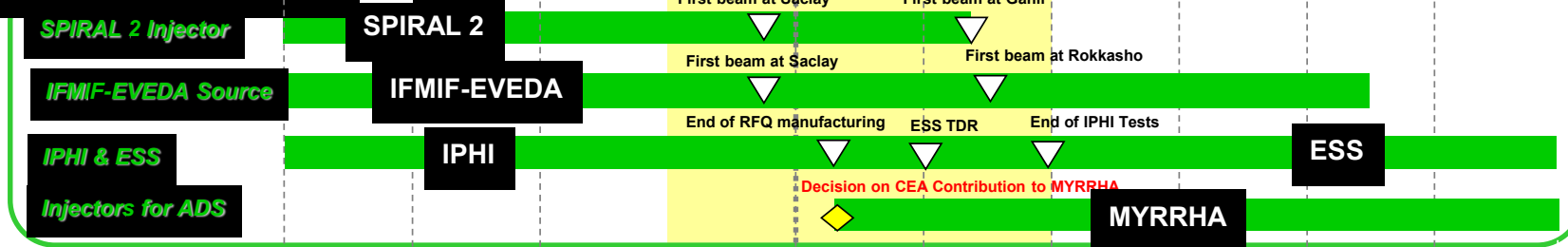
Superconducting Magnets



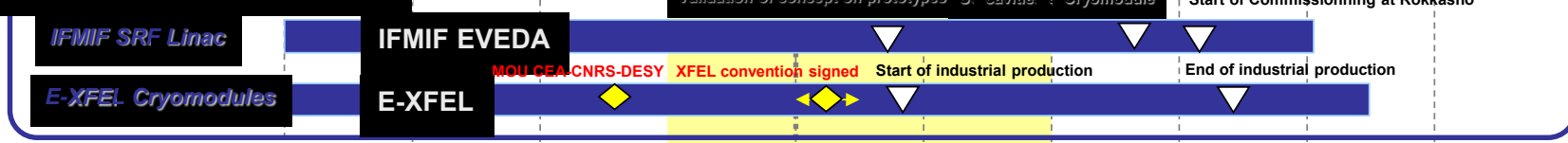
Cryogenic Tests Facilities



Sources and Injectors



Superconducting LINACS

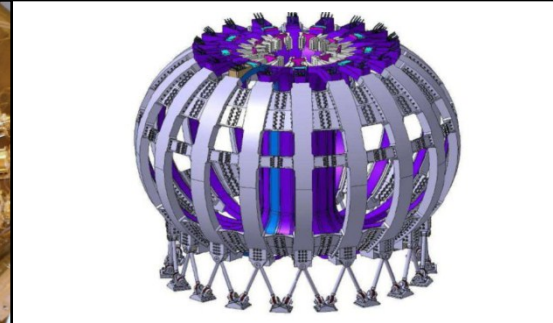


III. Applying research and technologies

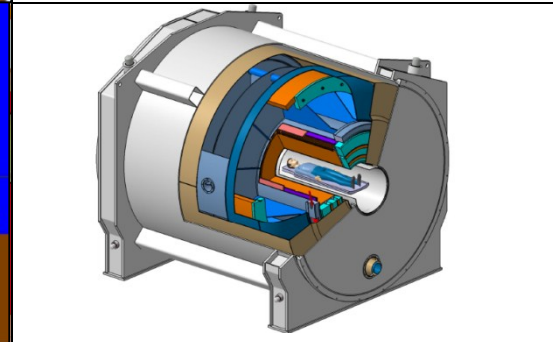
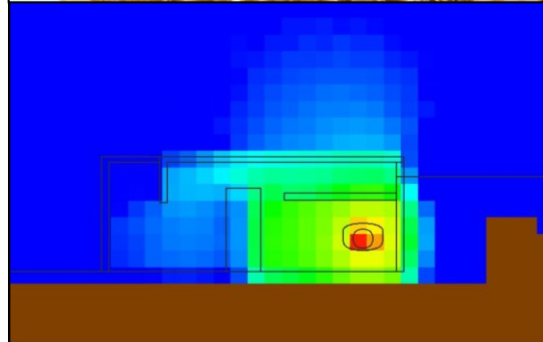
knowledge

Know-How

Energy



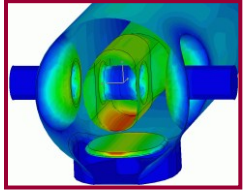
TGIR





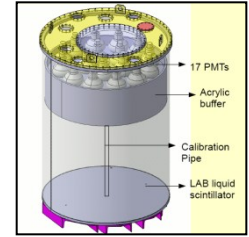
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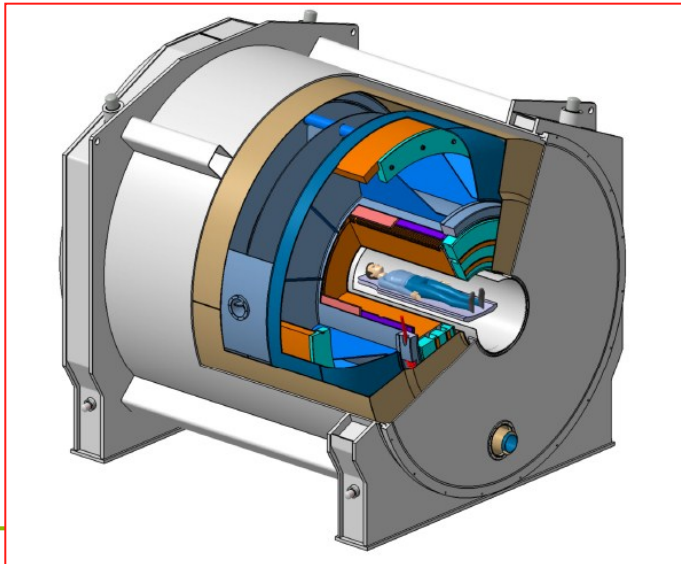
1. Nuclear energy

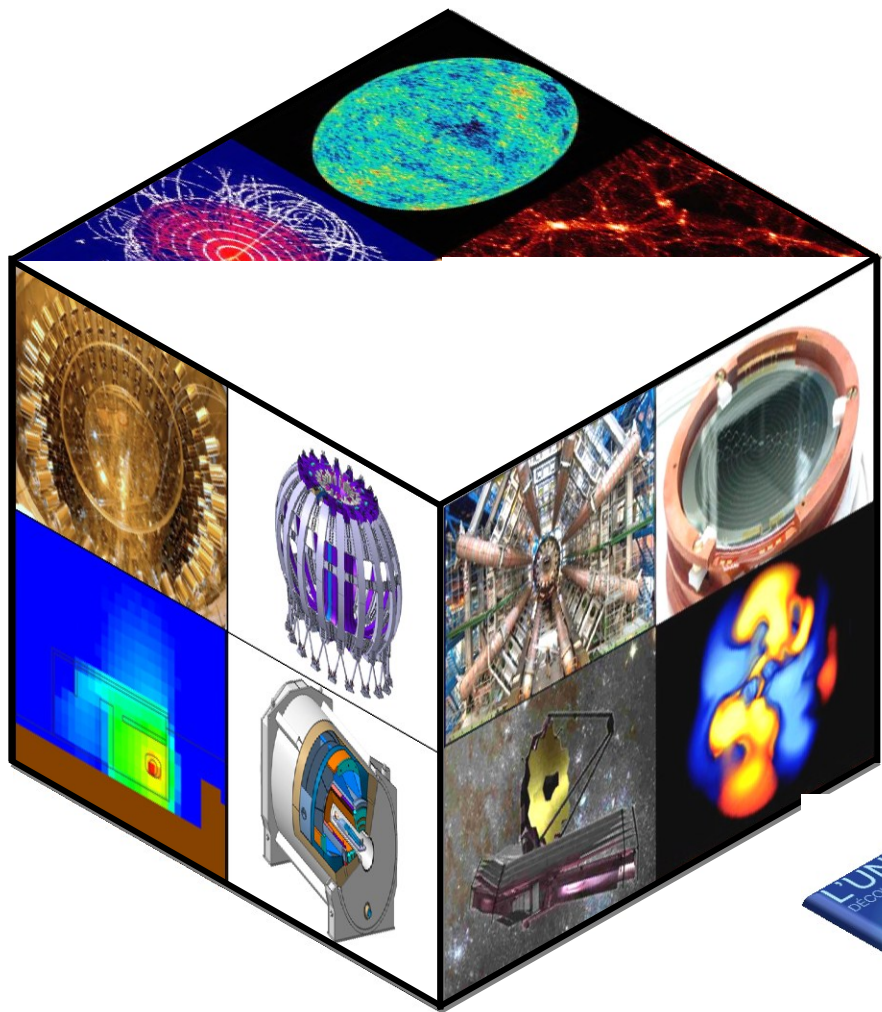
- Nuclear data and techniques (Nucifer)
- Fusion & Broader approach (IFMIF-EVEDA, JT60Sa, W7x)



2. Application for society

- Material science (XFeL, ESS)
- Application to life science (ISEULT)



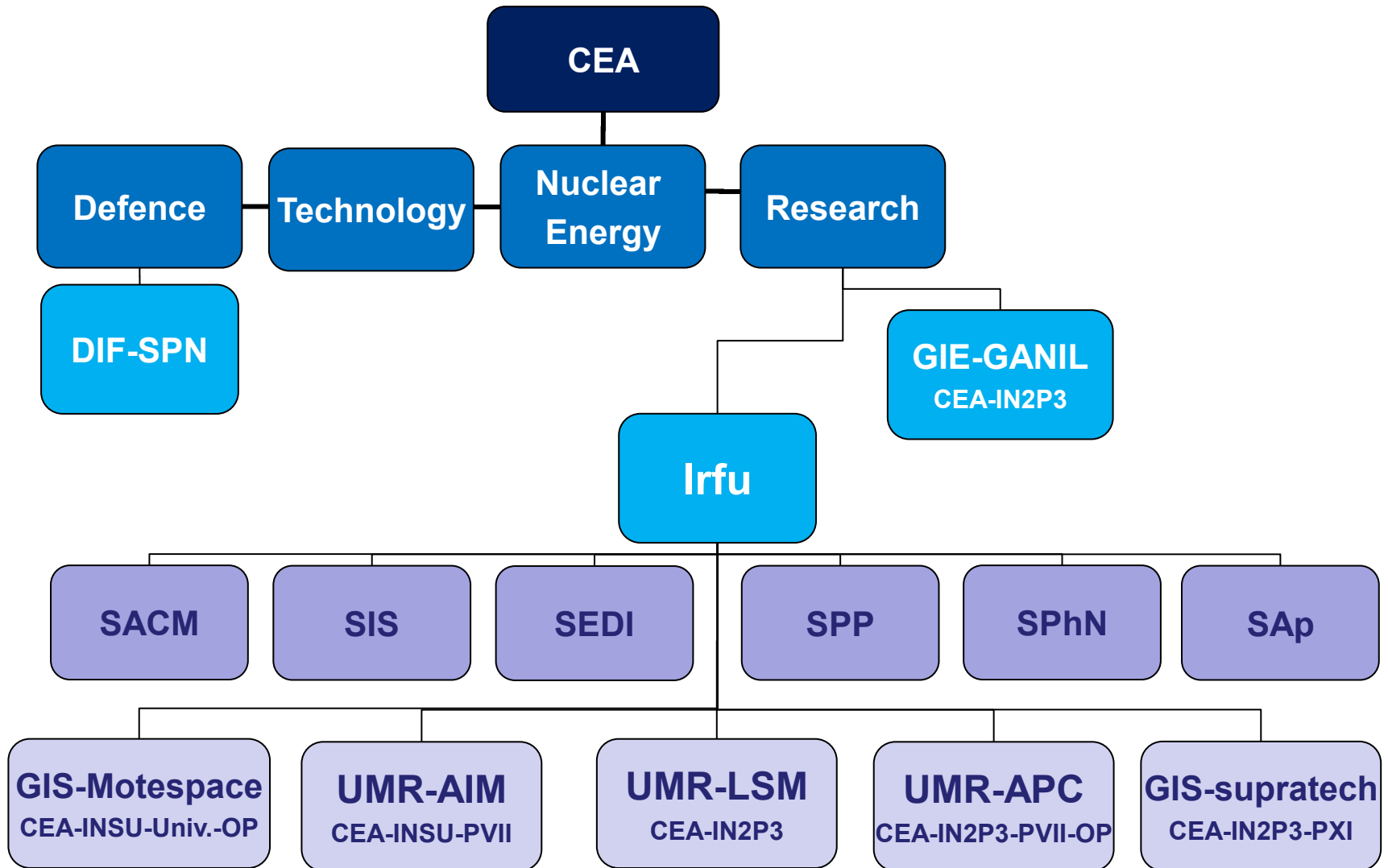


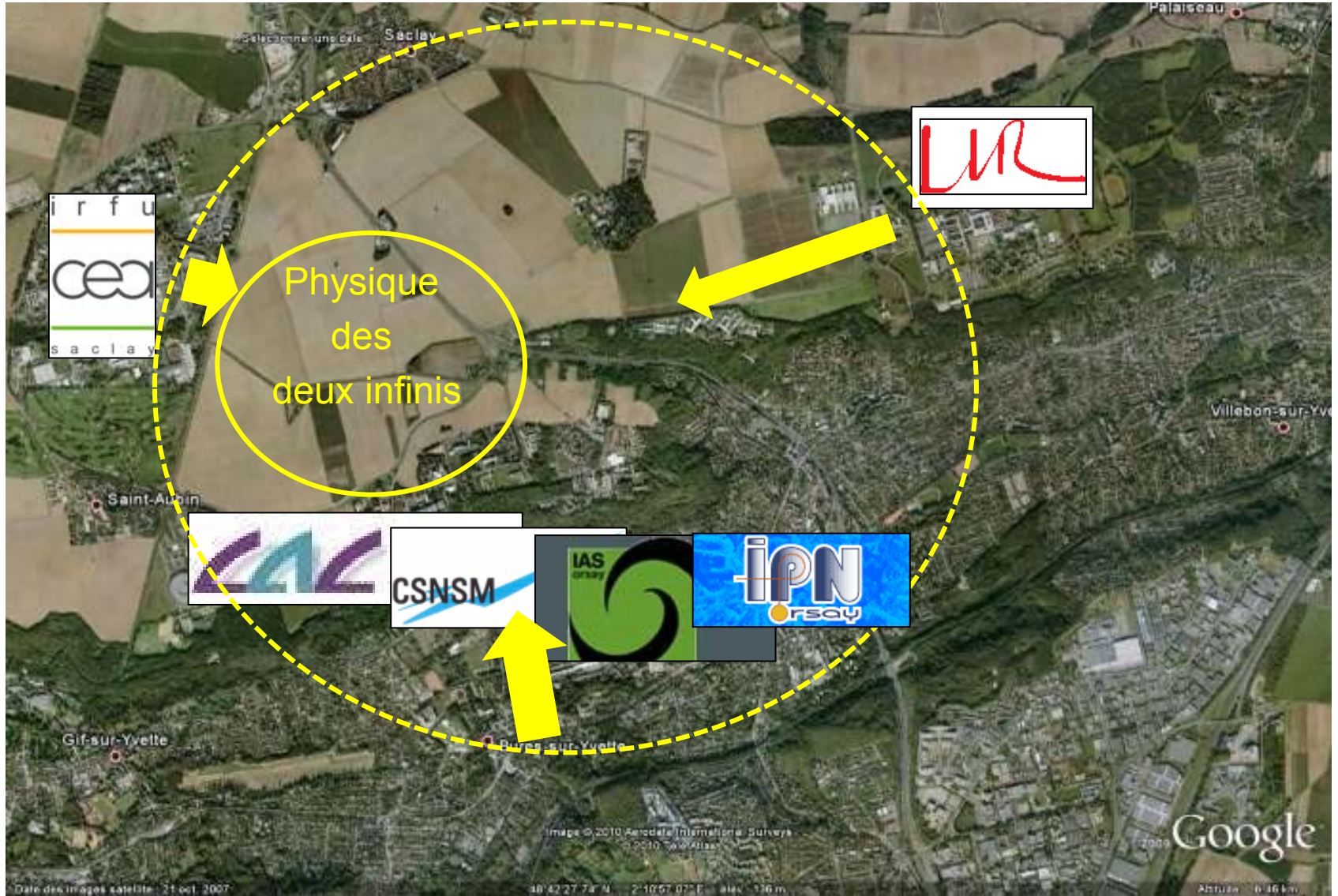
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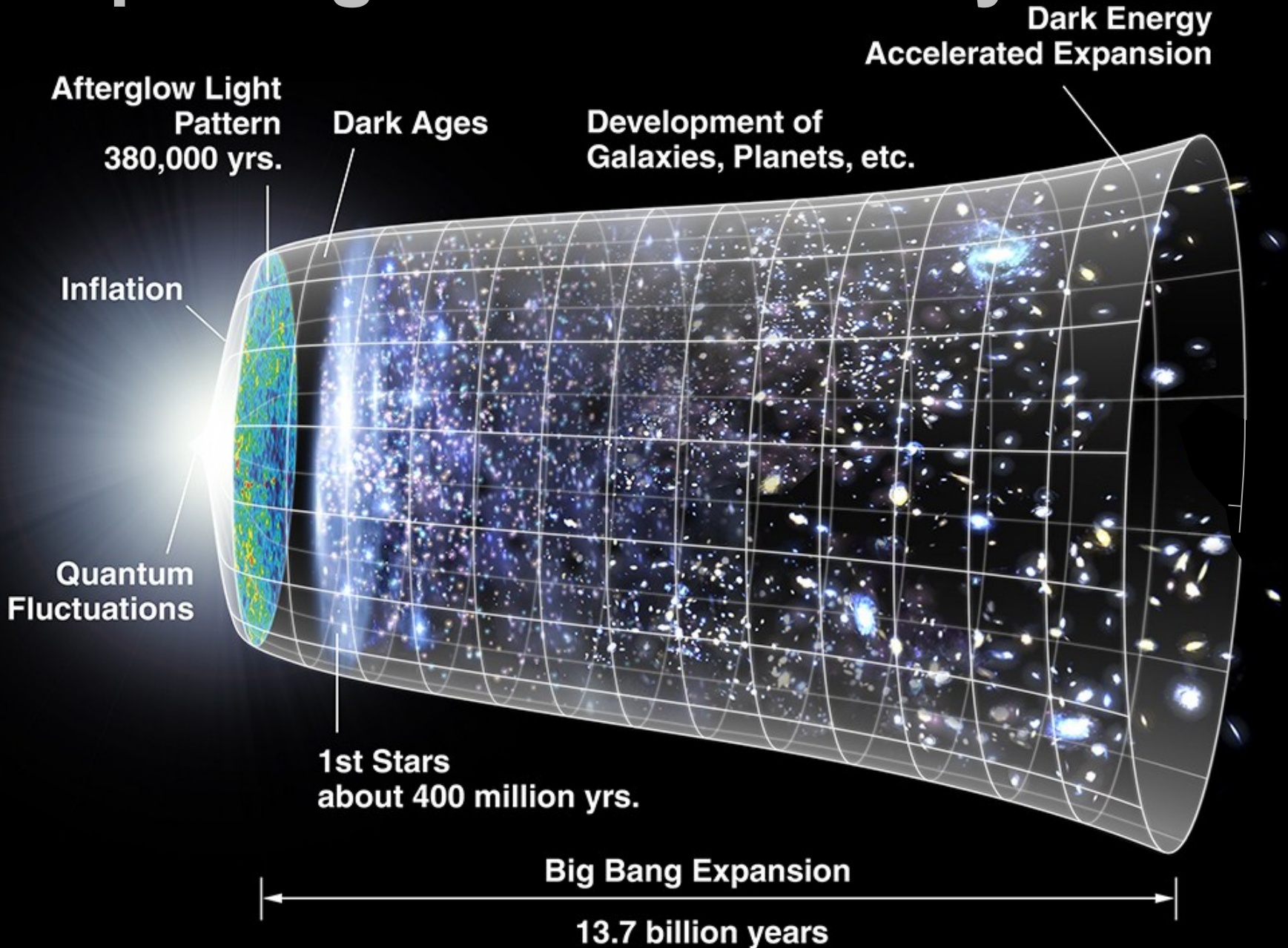
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CEA organization and CNRS/Universities common labs





Exploring Universe history



Exploring Universe history

15 thousand million years

1 thousand million years

300 thousand years

3 minutes

10^{-5} seconds

10^{-10} seconds

10^{-34} seconds

10^{-43} seconds

10^{32} degrees

10^{27} degrees

10^{15} degrees





10^{10} degrees

10^9 degrees

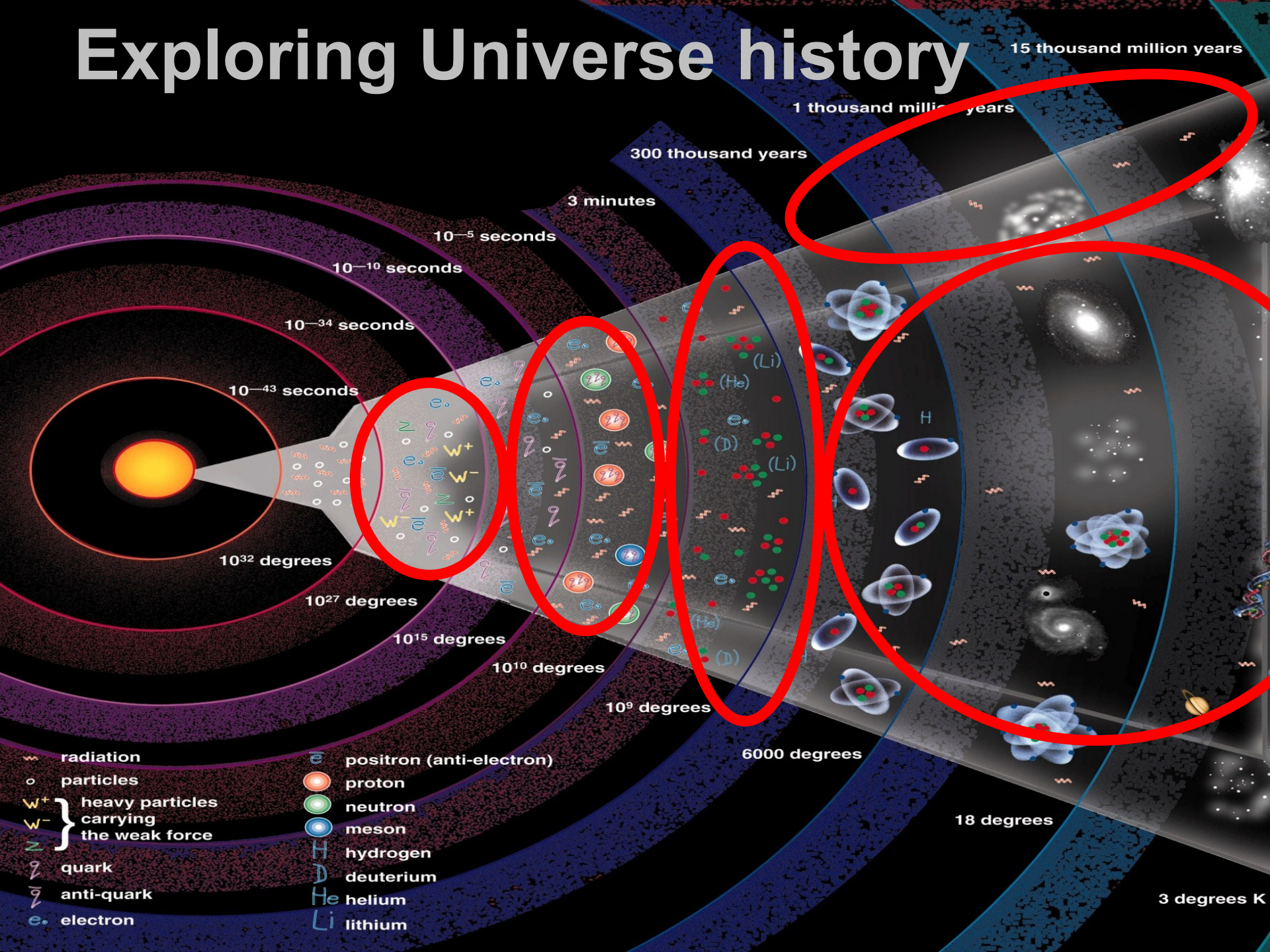
6000 degrees

18 degrees

3 degrees K

-  radiation
-  particles
- W^+ } heavy particles carrying the weak force
- W^- }
- Z }
-  quark
-  anti-quark
- e^- electron

- e^+ positron (anti-electron)
-  proton
-  neutron
-  meson
- H hydrogen
- D deuterium
- He helium
- Li lithium



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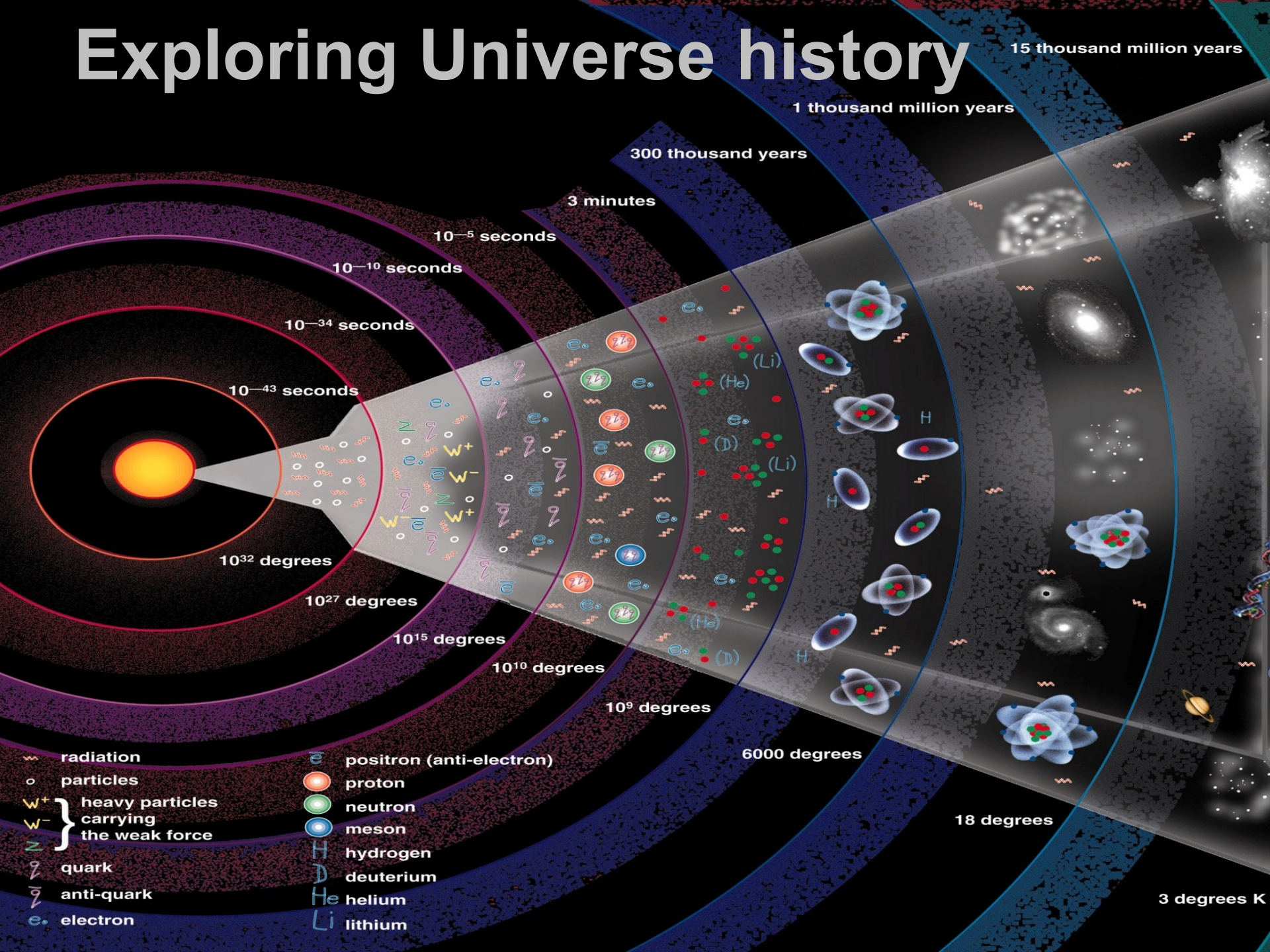
6000 degrees

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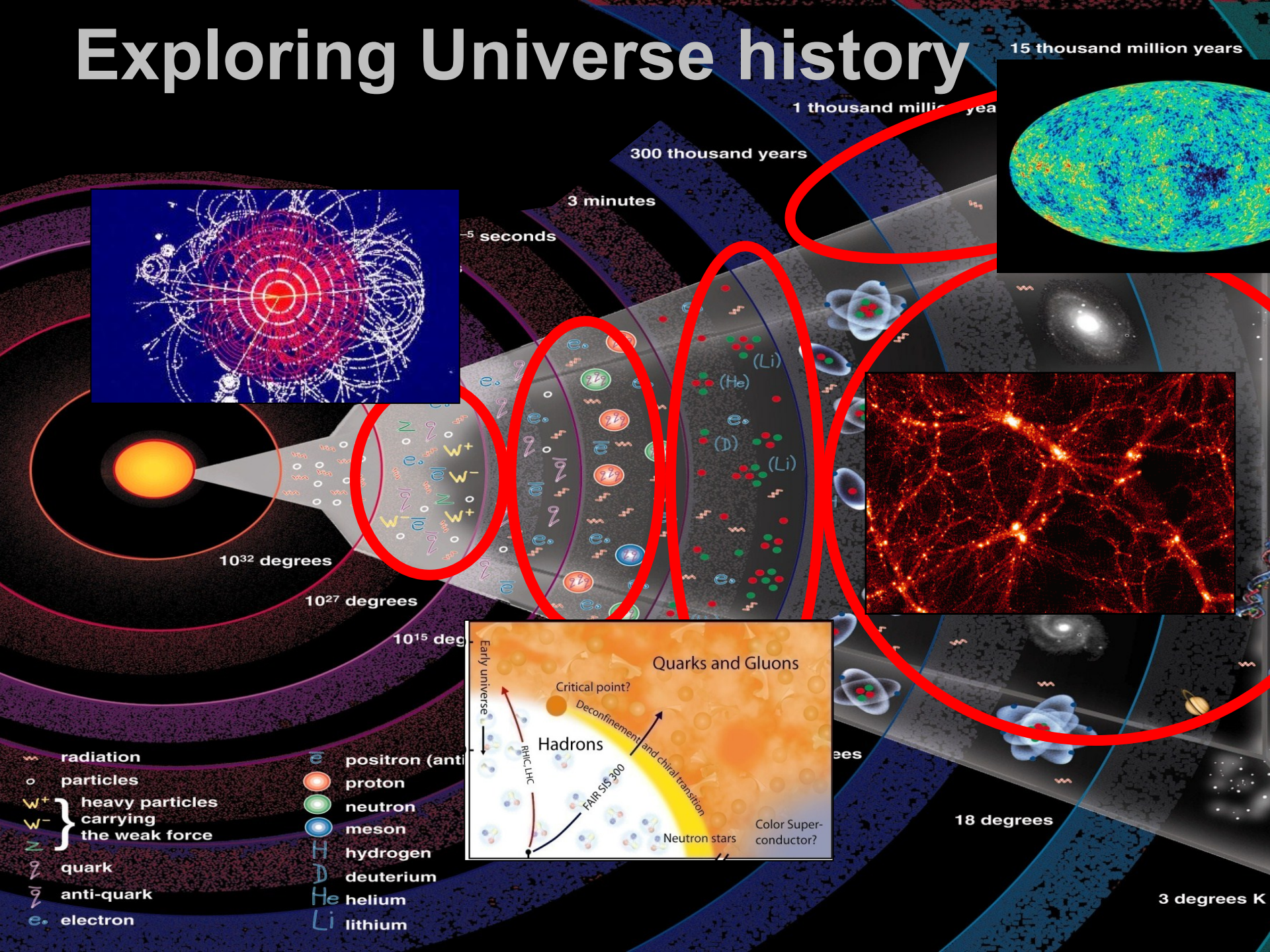
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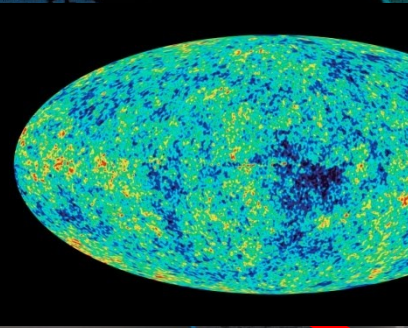
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- heavy particles carrying the weak force
- heavy particles carrying the weak force
- heavy particles carrying the weak force
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- anti-quark
- electron
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- proton
- neutron
- meson
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- deuterium
- helium
- lithium

