P.C.T.O. di Fisica

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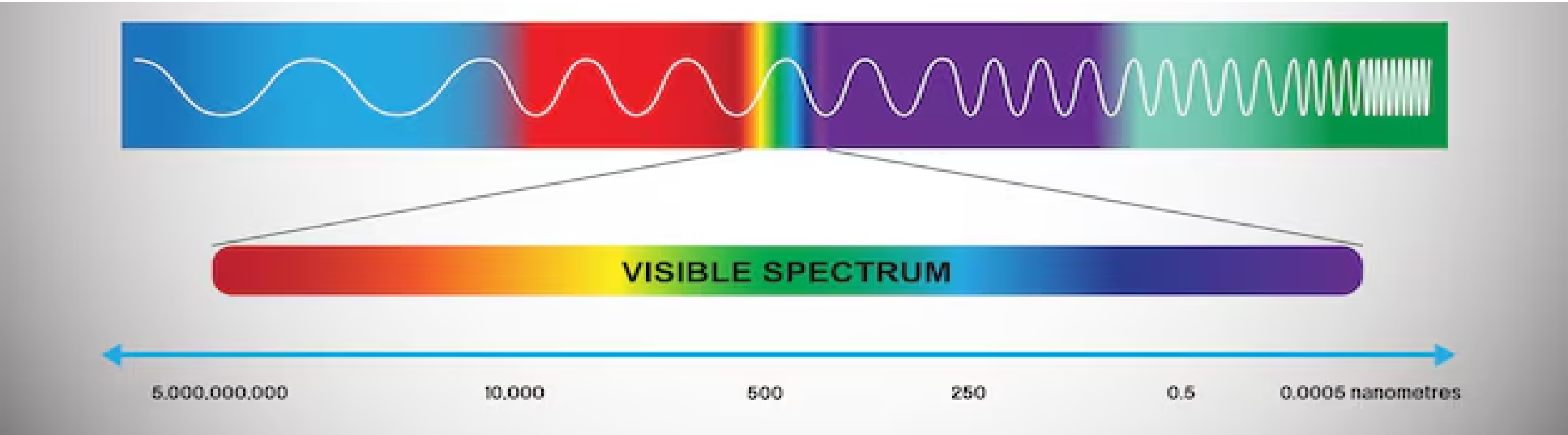
Presentazione presso l'Università Federico II di Napoli per l'INFN (Istituto Nazionale di Fisica Nucleare) OCRA (Outreach Cosmic Ray Activities)

The electromagnetic mirror

Our eyes can perceive only a range of the electromagnetic mirror, ranging from 750 to 380 nanometres (nm). This band is called the «visible spectrum» and corresponds to less than one octave of the extent of the electromagnetic mirror. So our eyes are not able to perceive infrared, ultraviolet or cosmic rays. Our body is crossed every second by about 60 billion invisible and elementary particles.



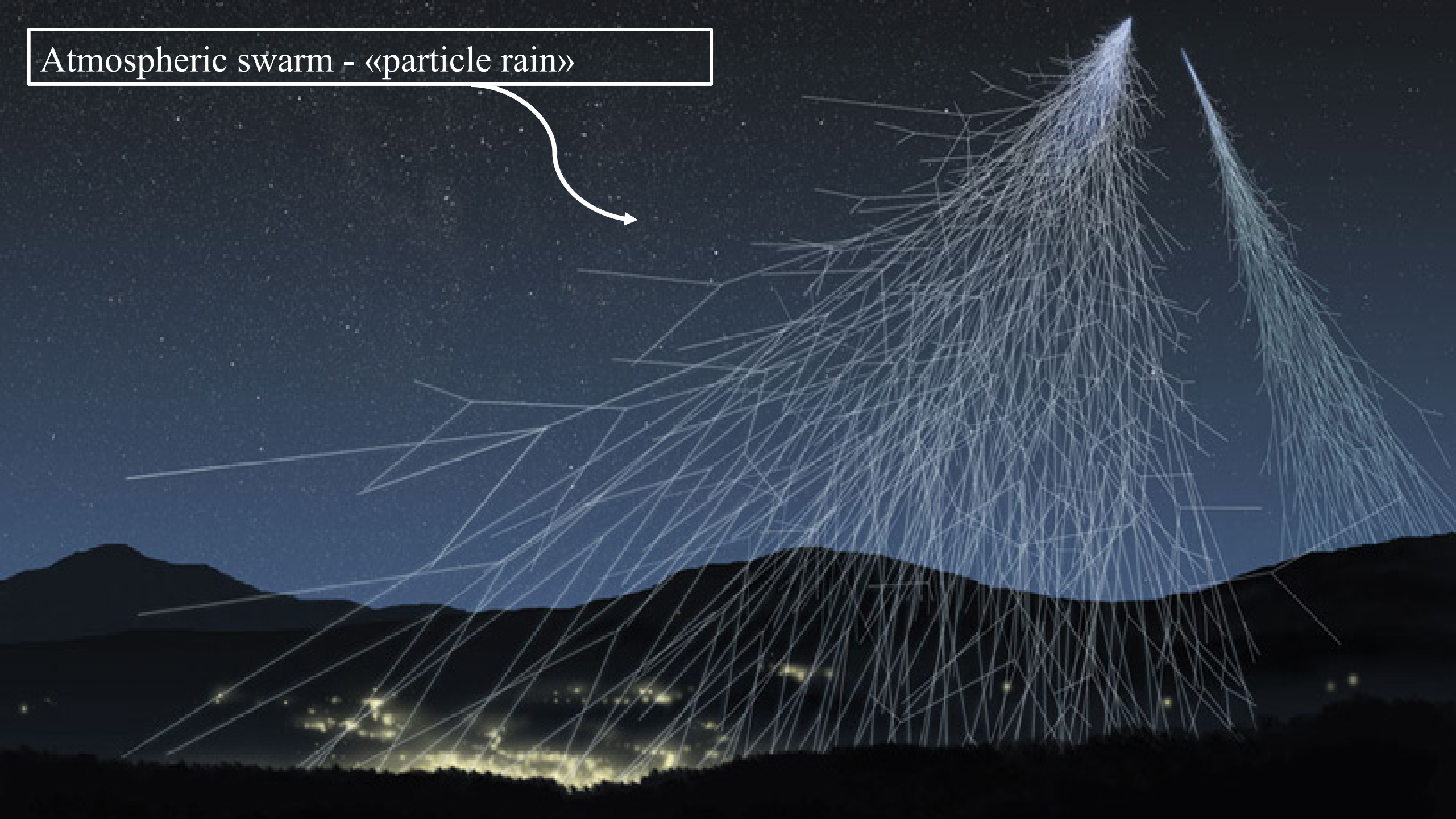
The cosmic rays

Victor Hess in the hot air balloon (7 April 1912)

- The cosmic rays were discovered by Victor Hess on 7 April 1912, climbing a hot-air balloon at an altitude of 5300 m during an almost total solar eclipse.

- The cosmic rays come from space, stopped by the atmosphere, where daughter particles are generated: electrons, protons, quarks, muons... The latter being heavier than the electrons are more easily stopped.

- To study cosmic rays, particle detectors are used which can be sent out of the atmosphere, thus making direct measurements; or they can be placed on the ground, by making indirect measurements. Thanks to the latter we can study particle swarms, also called "atmospheric swarms".


Atmospheric swarm - «particle rain»

THE MUONS

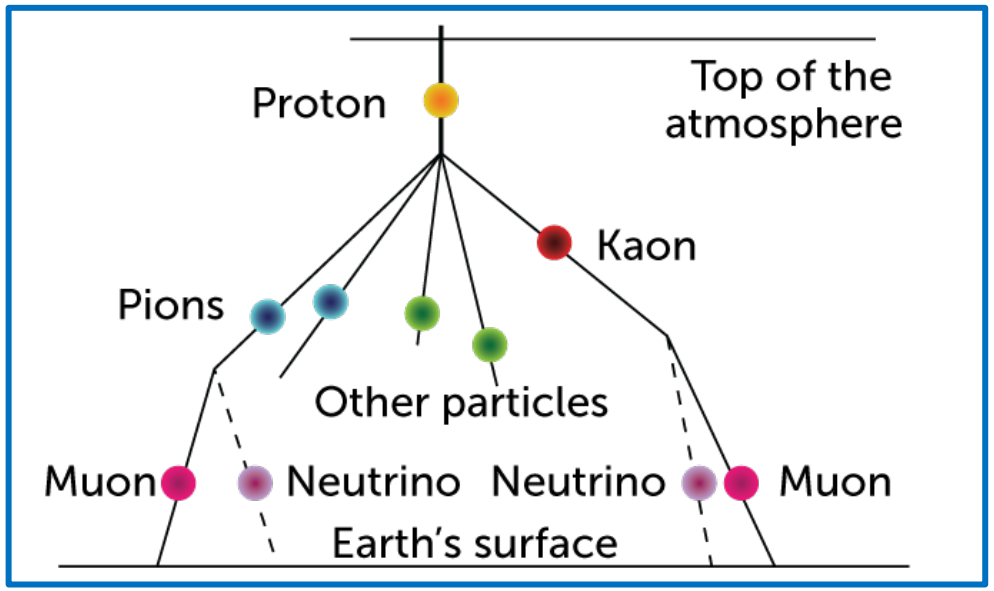
Exploring the muons world!

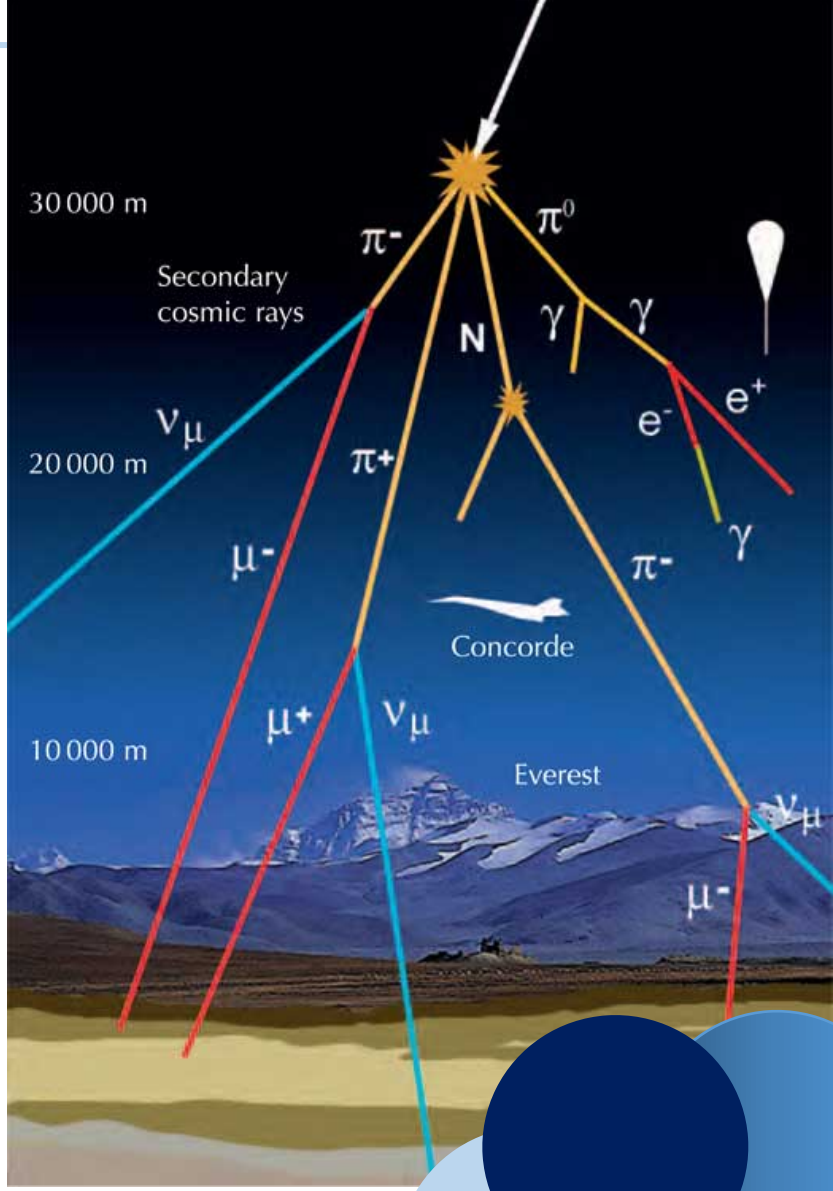
The muons are subatomic particles with a very penetrating charge similar to electrons, but with a mass 200 times greater and travelling almost at the speed of light (300,000 km/s).

The muons live about 2.2 millionths of a second, stopping at a few tens of meters from the underground.

How can muons reach us when the earth's atmosphere is 15,000 m thick and muons die after 660 m?

As we well know, space and time are relative quantities, according to the reference system in which we place them. For muons, the time of life dilates by about 40%, while the atmosphere is 600 m thick and can reach Earth.





The scintillators

How, then, can we detect particles and study them?
This is possible thanks to particle detectors, through which part of the energy released by a particle is converted into some form perceptible to man.
We have different types of detectors, the ones known to us are scintillators.

A scintillator consists mainly of:

- Four particle detectors working in coincidence;
- Four LED floors;
- Six scintillator sticks (SiPM, Silicon Photo Multiplier);
- Optical fibres;
- A Photomultiplier;
- A Discriminator.


The
End

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