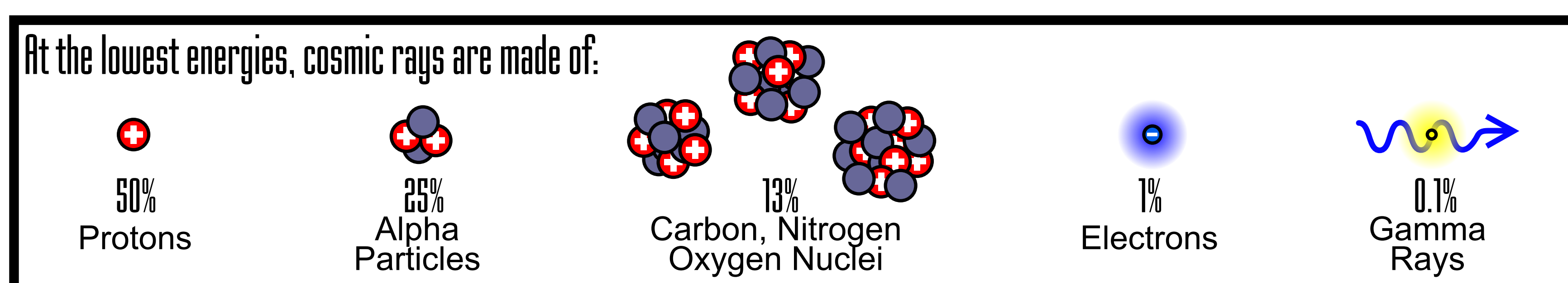


# What are Cosmic Rays?

Cosmic rays are energetic, subatomic particles that arrive from outside the Earth's atmosphere. The lowest energy cosmic rays are produced by ordinary stars like the Sun. For example, during a solar flare many particles are ejected from the Sun. When these solar particles interact with the Earth's magnetic field, they tend to spiral into the Earth's magnetic poles where they excite the gas in the atmosphere causing it to glow. This is observed as Aurora, or the Northern/Southern Lights.

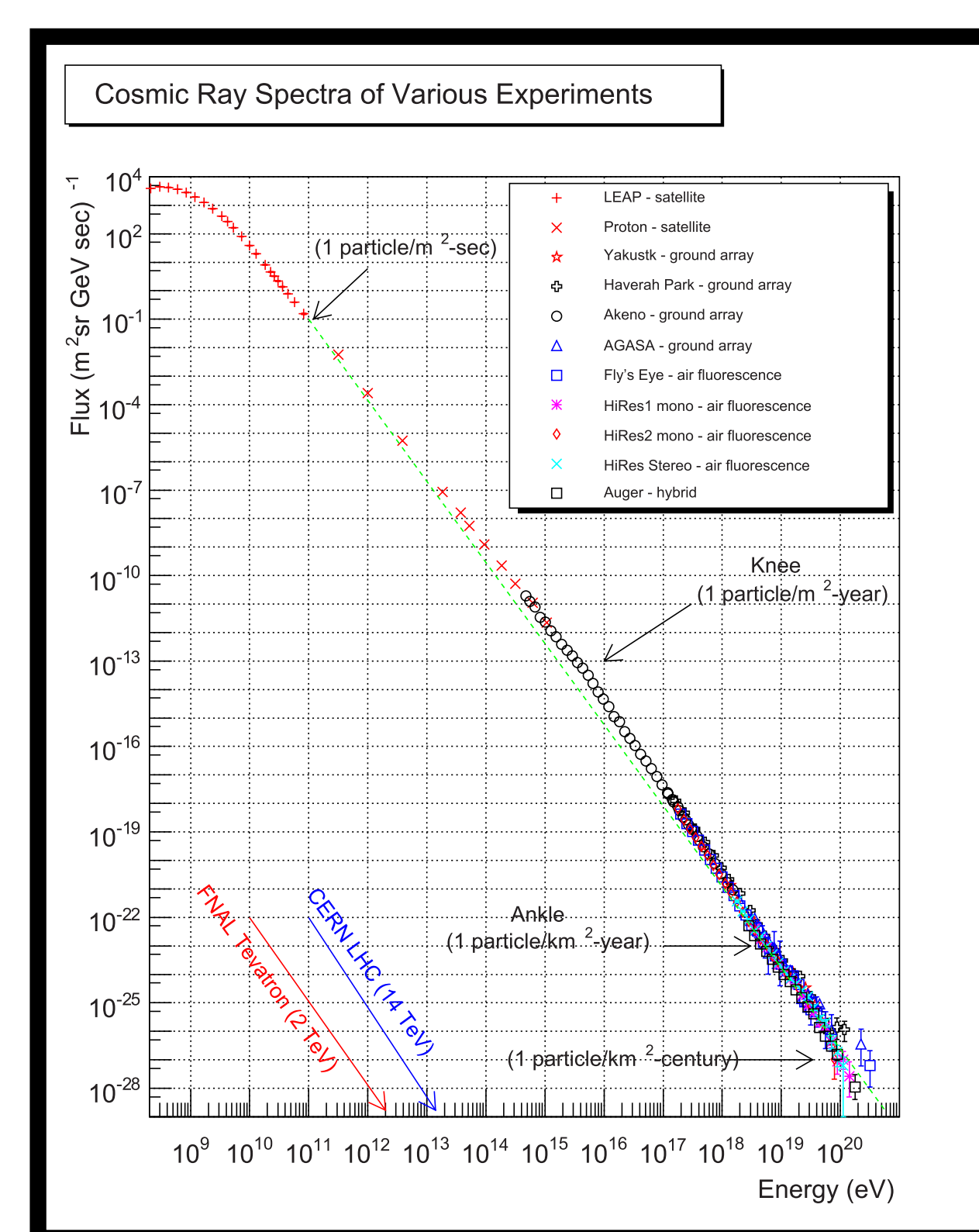


## The Energy of Cosmic Rays

Cosmic rays arrive with a variety of energies. At the lowest energies, cosmic radiation is very common. These particles originate from sources close to Earth such as the Sun. We are shielded from most of the low energy particles by their interaction with the Earth's atmosphere and magnetic field.

The basic unit of measurement used in discussing the energy of a cosmic ray is the electronvolt, or eV. One eV is the amount of energy gained by a single electron when passing through an electric potential of one volt. Common batteries (such as a D-cell) have a potential of 1.5 volts, so a single electron through a regular battery will gain 1.5 eV.

As the energy of the cosmic rays increases, the frequency of the particles decreases steeply. On arrival at the Earth, their path experiences less bending in the magnetic field and they penetrate deeper into the atmosphere. Particles with intermediate energy levels, around what is called the "Knee" of the spectrum, are called Very High Energy cosmic rays and they occur with a frequency of one per square meter per year. For the highest energy cosmic rays, above  $10^{16}$  eV or what is called the "Ankle," the rate of events falls to one per square kilometer per century.



## The Origin of UHE Cosmic Rays

The leading candidates for the source of Ultra High Energy cosmic rays are large, energetic structures where strong shocks are expected to be found. The most well known of these are supernova remnants, which have long been suspected to generate cosmic rays. Still, it is difficult to explain the existence of cosmic rays above  $10^{16}$  eV, because supernovae are simply not large enough to maintain acceleration for Ultra High Energy particles. Scientists suspect other large structures such as active galactic nuclei or colliding galaxies might be candidate objects which produce or accelerate these cosmic rays. The source for these very energetic particles, however, is still unknown. Telescope Array is looking for possible sources of these Ultra High Energy cosmic rays to provide a better understanding of the nature of the universe.

