



## HOW ARE NEUTRINOS PRODUCED?

**There are many ways to produce neutrinos in our Universe.**

A large number of them were produced at the very early stage of our Universe, following the Big Bang which occurred about 13.8 billion years ago. There are so many of these neutrinos in the whole Universe but they only carry a very small amount of energy and we could not observe them so far.

The Sun (our Sun!) continuously produces a lot of neutrinos: in the core of the Sun happen some nuclear reactions that produce a large number of neutrinos that we can even detect at Earth.



Further away in the cosmos, supernovae and blazars, some of the most explosive phenomena happening in our Universe, can also produce neutrinos in different energy ranges.

To tell you the truth, for some neutrinos we are not sure yet where they come from: are they coming from Gamma-Ray Bursts, or maybe from the Active Galactic Nuclei of far distant galaxies, or even maybe from dark matter?!? Finding out the exact origin of our astrophysical neutrinos is a very active and exciting field of research.

**Neutrinos can also come from closer sources, like... our own atmosphere!**

Yes – from the air just above your head! Energetic particles coming from the Universe are hitting our atmosphere every second and can create many smaller particles: among them, at sea level, neutrinos are, once again, the most common particles (we told you: neutrinos are everywhere...).

**Are neutrinos also produced on Earth?**

The answer is again yes! Neutrinos can be generated in radioactive decays of unstable nuclei. Actually, nuclear power plants (and, in the worst case, nuclear bombs) also produce neutrinos! But no worries – our dearest particle is never dangerous, no matter where it comes from.

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