



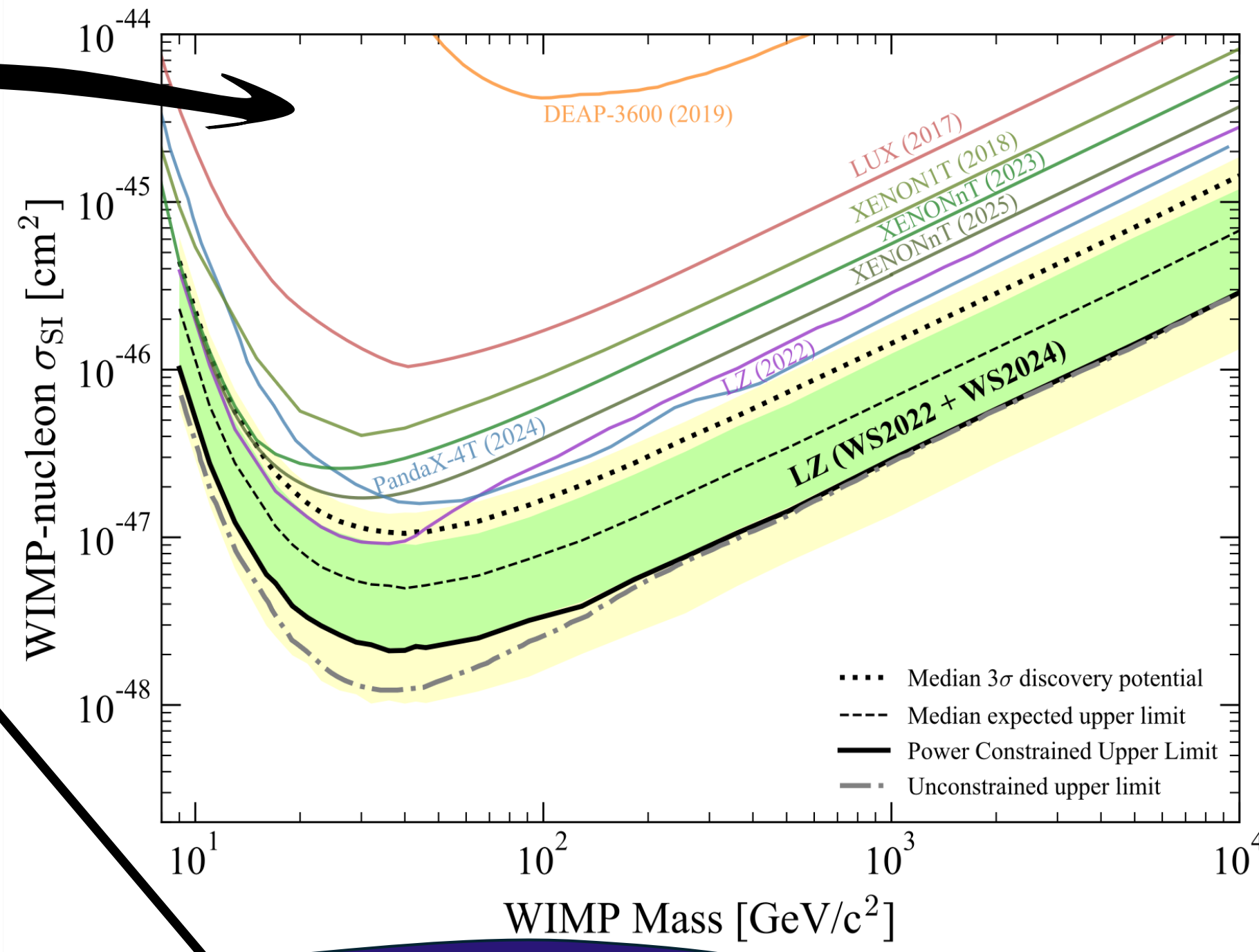
How it works

and what you might want to do with it!

Dark Matter

The evidence for dark matter is coming from galaxies & clusters as well as cosmology. All of which is only gravitational! For example: Galaxies are rotating with a speed larger than expected by the gravity generated by the observable matter in the center of the galaxy. A well motivated dark matter particle is the *Weakly Interacting Massive Particle* (WIMP).

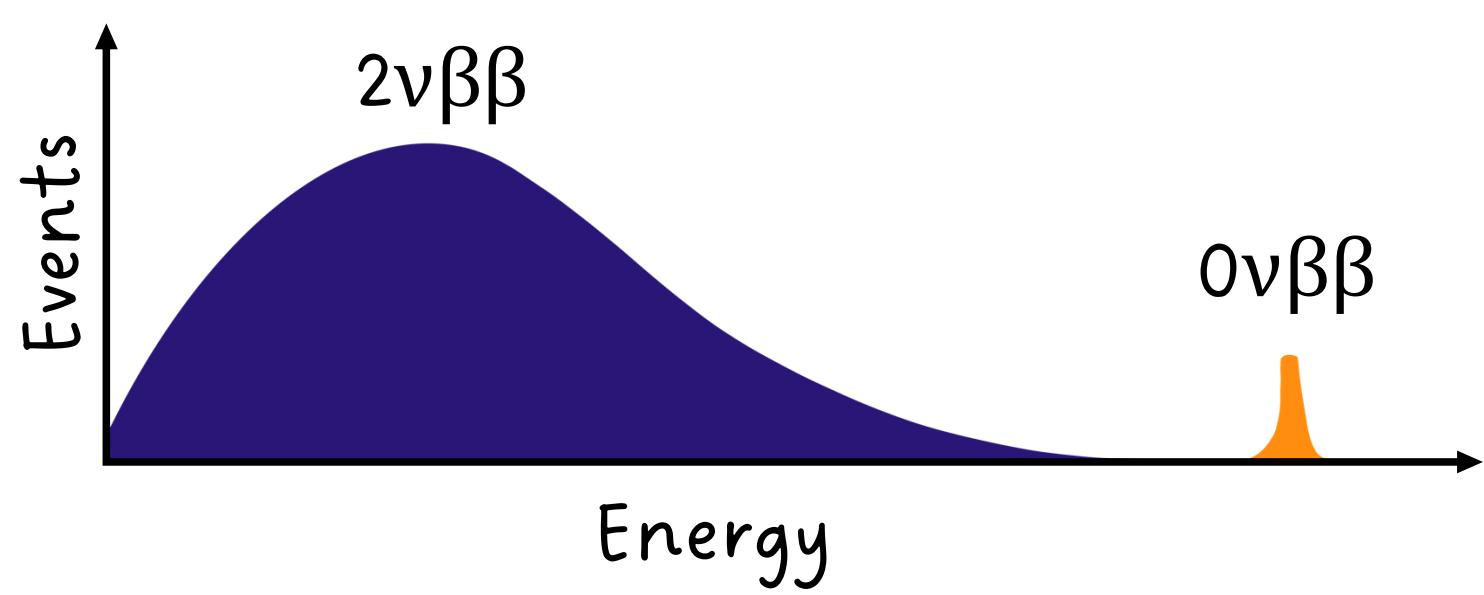
LZ has the *world's best limits* on the cross section for WIMPs in the GeV mass region.



0νββ Decay

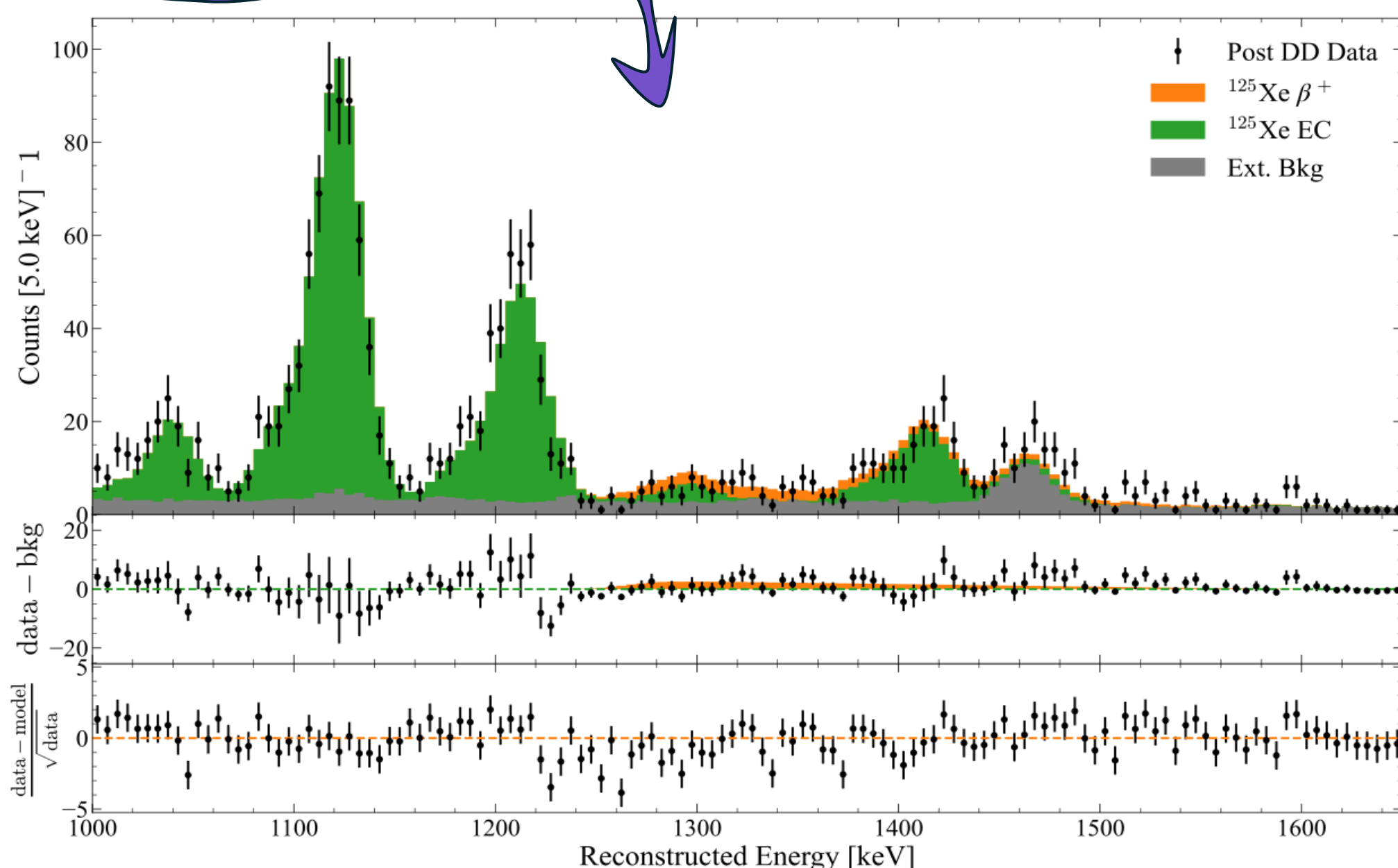
Neutrinoless double beta decay is a theoretical process where the beta decays share the same neutrino. Finding a 0νββ decay would *prove the Majorana nature of the neutrino* and the violation of the lepton number conservation.

In LZ we are looking for 0νββ of ¹³⁶Xe.



study of nuclear decays

¹²⁵Xe is an activation product of the neutron calibrations and primarily decays via electron capture (EC), but has a weak positron (β⁺) contribution (~0.3%). LZ has set a *preliminary first constraint on the positron mode* to the individual 243 keV and 188keV branch levels of ¹²⁵I.



study of solar neutrinos

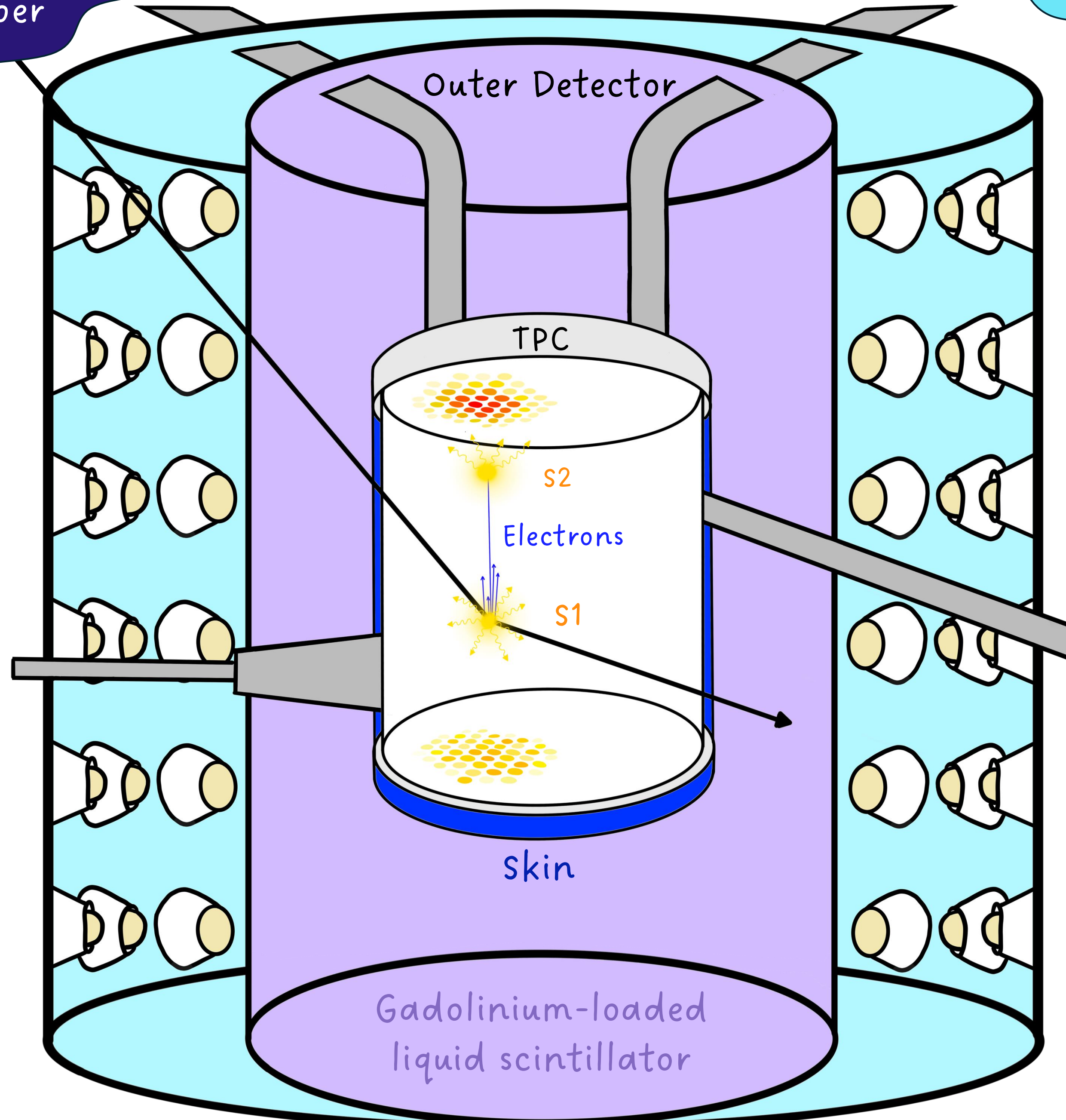
study of cosmic muons

study of supernovas

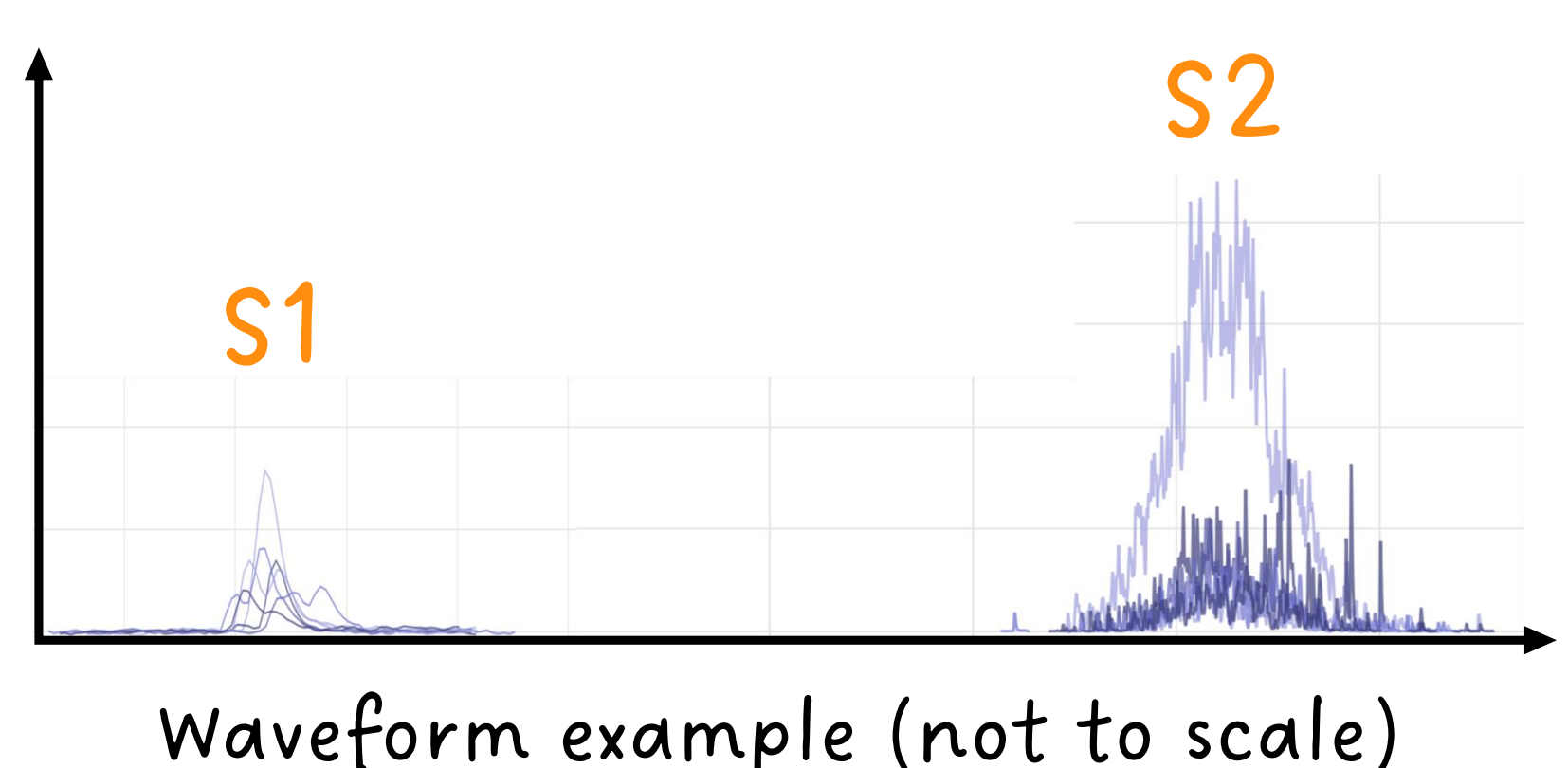
Place it underground
To reduce the background as much as possible the LZ detector is placed 1480m underground in the Sanford underground laboratory in South Dakota.

Build it clean and shield it
The internal background radiation was reduced by building the detector under hyper clean conditions. For suppressing the background present in the cave an outer shield is stopping low energetic particles and tagging high energetic particles.

Working principle of a TPC



Incoming particles scatter of the xenon nuclei or its electrons. This scatter process creates *primary scintillation (S1)* and liberates electrons during recombination processes. With the help of an electric field the electrons are drifted towards the top of the TPC and scintillate in the gaseous xenon creating a *secondary signal (S2)*.



The *ratio of the area S1 to S2* can discriminate between nuclear recoil and electron recoil.

