XENONnT ongoing analysis efforts at LPNHE

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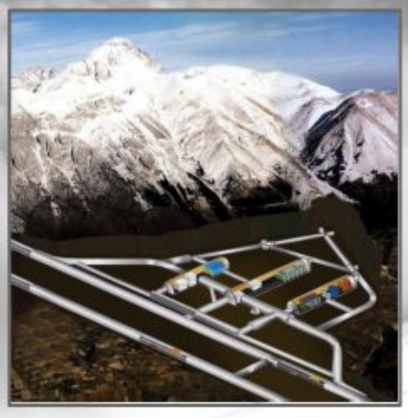
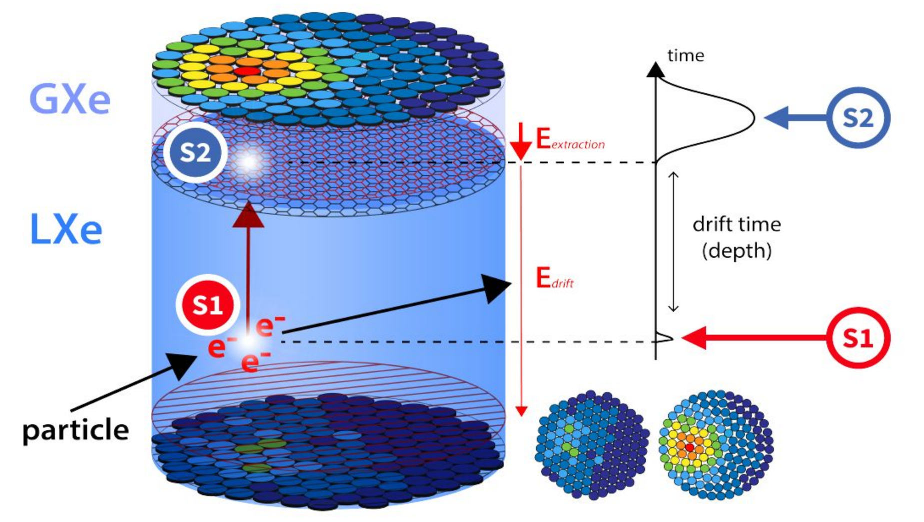


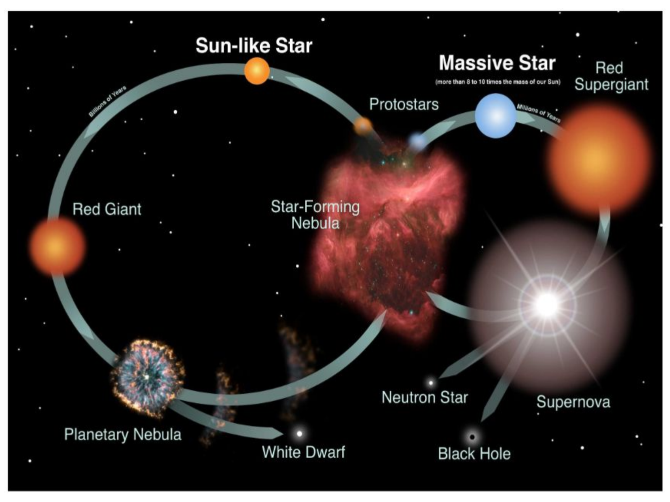
XENON is located in Italy, in the Gran Sasso Underground Laboratory, 1,4 kilometres under the mountain rock

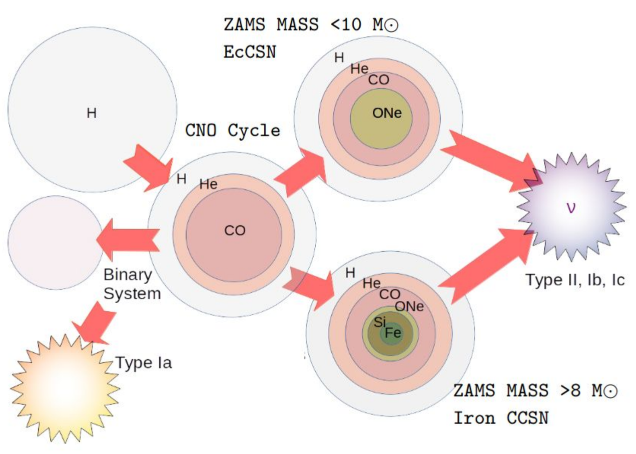
The detector is a cylinder ~1.5 metres high and ~1.5 diameter, surrounded by a 10 m cylinder full of water that acts as a veto system

Crédits : Erwann Masson

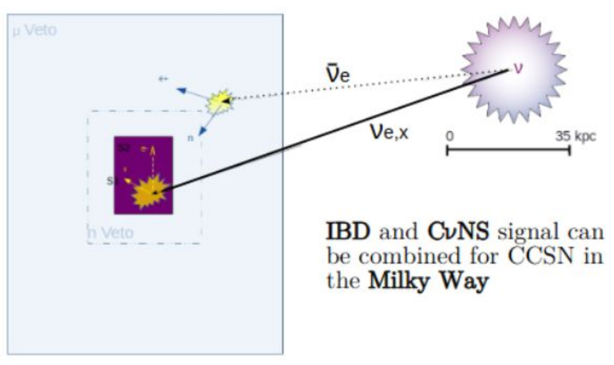


Core Collapse Supernova Neutrinos detection (Layos Daniel Garcia)

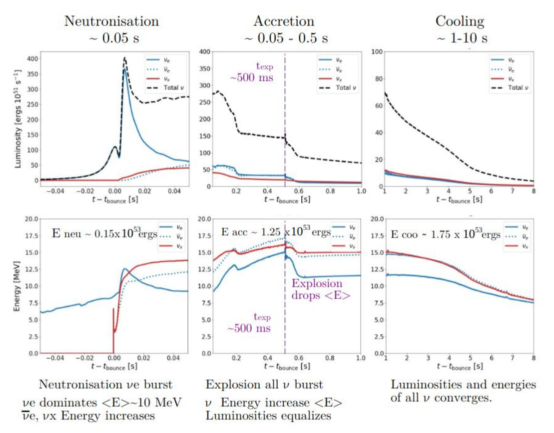




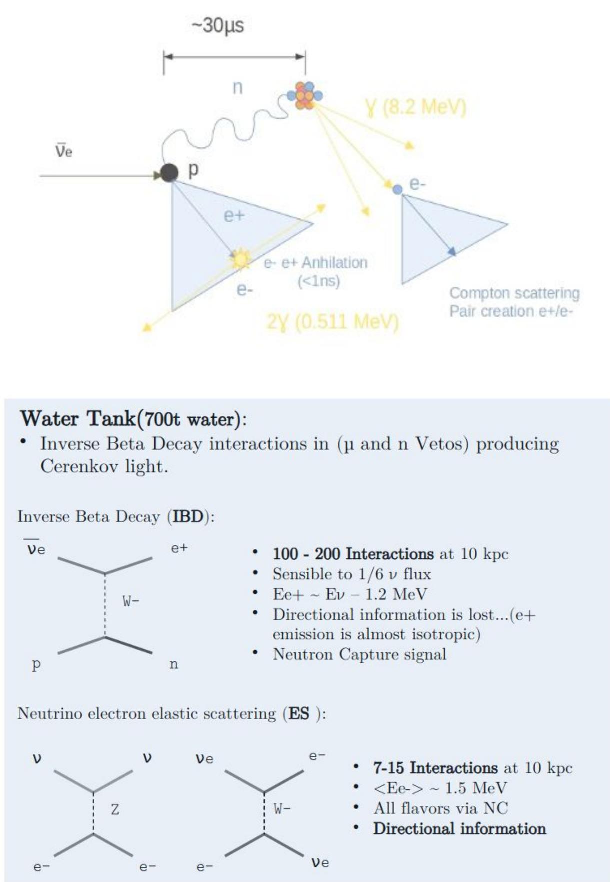
XENONnT, three detectors : LXe TPC, Neutron Veto, Muon Veto



Neutrino emission

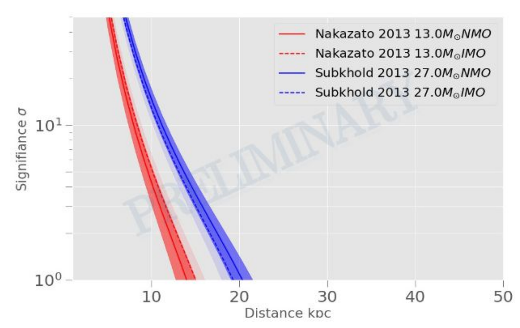


Inverse Beta Decay in water

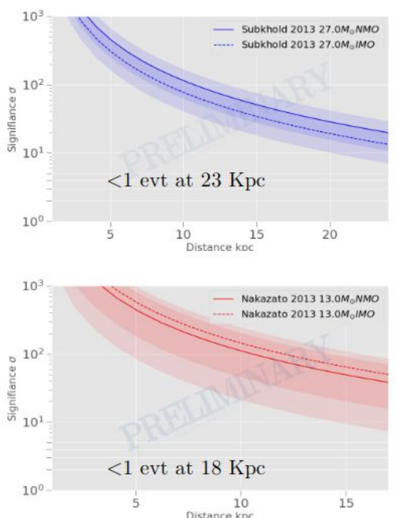


XENONnT significance in detecting a Supernova as a function of its distance from us

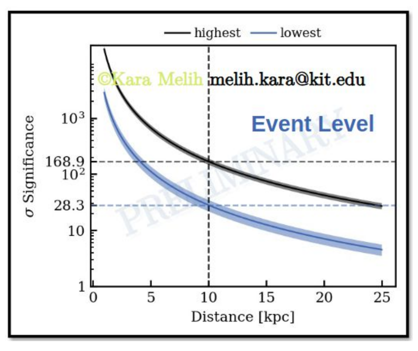
Muon veto only



Neutron veto only



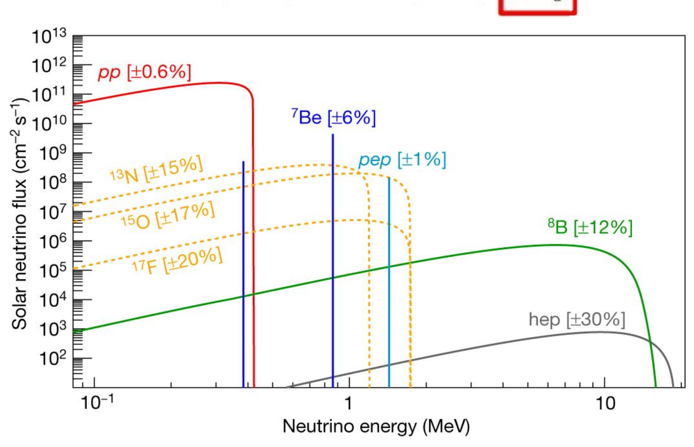
As reference: LXe TPC only



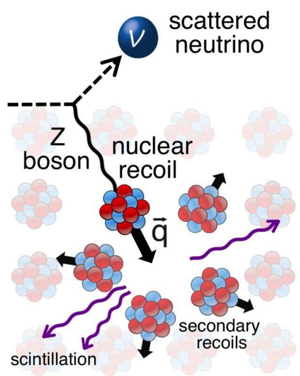
Search for Coherent Elastic Solar Neutrino Nucleus Scattering (Quentin Pellegrini)

Nuclear Reaction Chains in Solar Core

$$4\,H^{+} + 2\,e^{-} = {}^{4}He^{2+} + 2\,\nu_e$$



Coherent Elastic Neutrino Nucleus Scattering (CEνNS)



Coherence condition : qR< 1

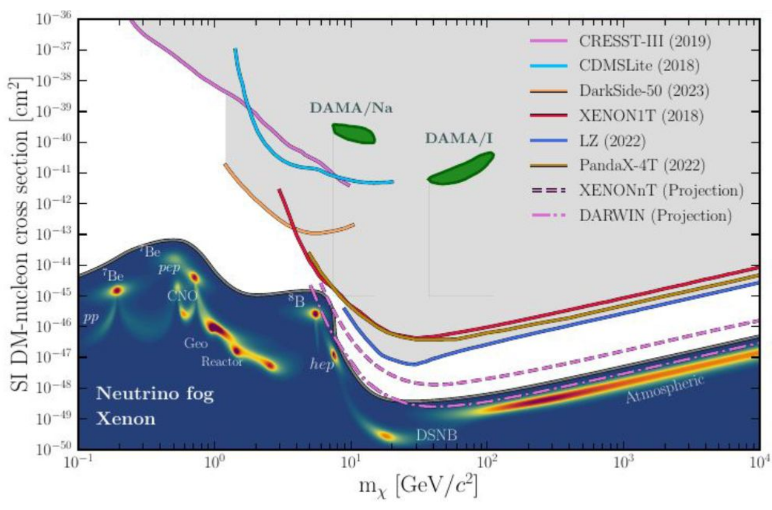
Low-energy neutrinos (< 100 MeV)

$$\sigma_{CE\nu NS} \propto N^2$$

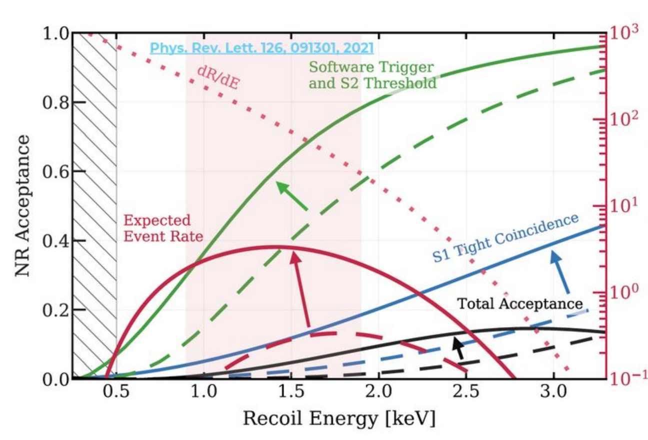
Low-energy NR events

XENONnT aims to detect world first astrophysical CEνNS signal

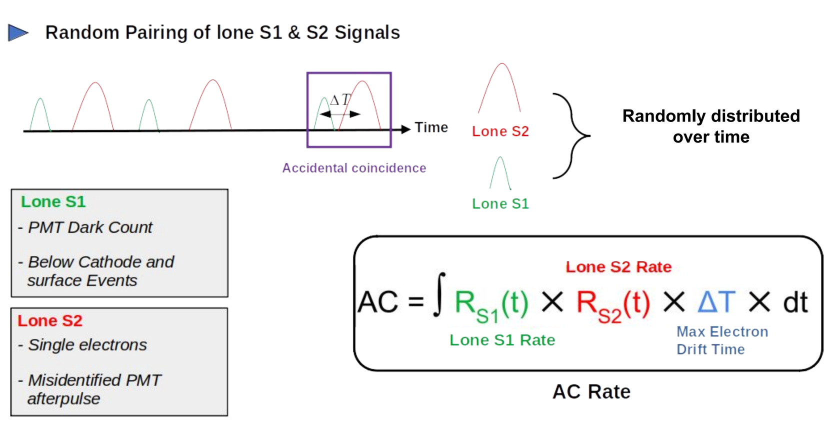
CEνNS and Direct Dark Matter Searches



Expected CEνNS Rate in XENONnT



Accidental Coincidences (AC)

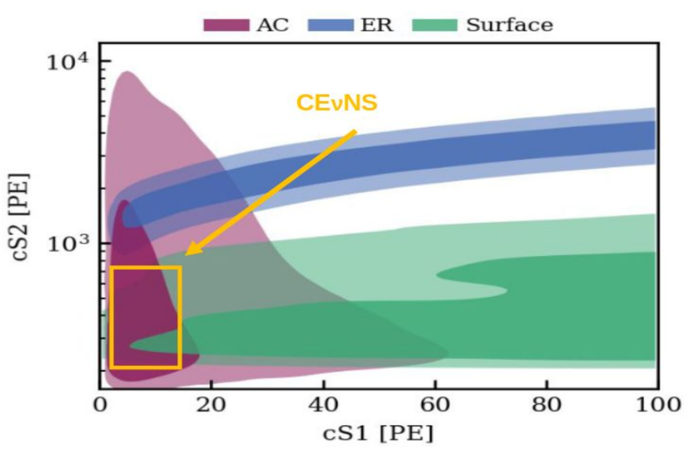


$$AC = \int R_{S1}(t) \times R_{S2}(t) \times \Delta T \times dt$$

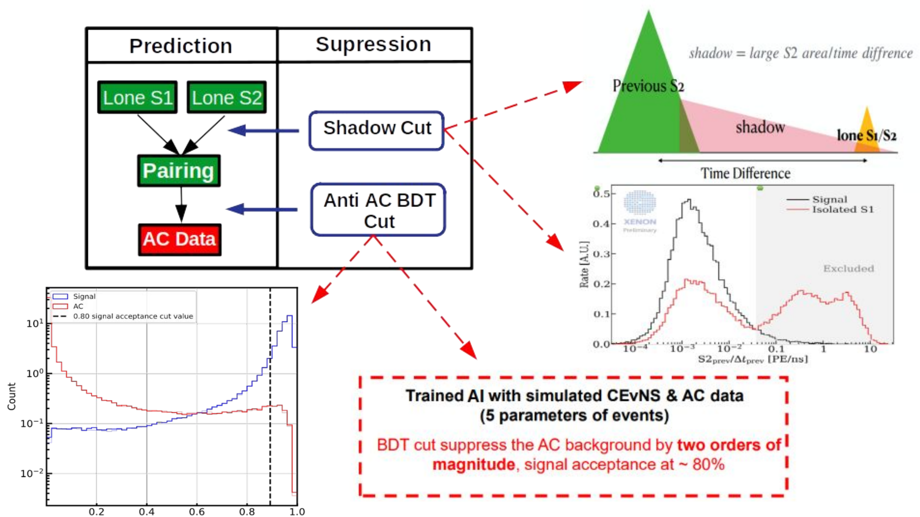
Lone S2 Rate; Lone S1 Rate; Max Electron Drift Time

AC Rate

Background for CEνNS Search



Accidental Coincidences Cuts



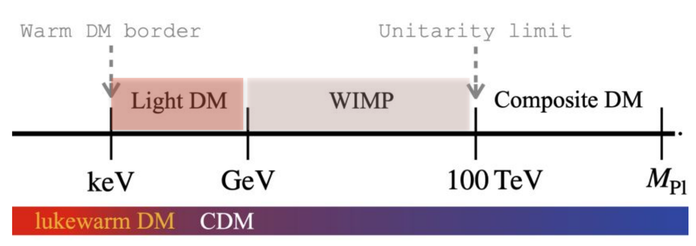
CEνNS Status in XENONnT

	CEνNS	AC	NR	ER
XENONnT	4.84	10.6	0.01	0.04
XENON1T	2.11	5.14	none	0.21

XENONnT vs XENON1T	XENONnT CEνNS Status	Expectations
Increased Exposure	SR0: Very advanced	Reach XENON1T AC Rate
Increased Detector Efficiency	SR1: Detector conditions changes (lot of work to do)	SR0+SR1 analysis for CEνNS evidence
Increased AC Background		

Light Dark Matter detection (Yongyu Pan)

Light dark matter model



Light DM (dark matter) through nuclear recoil (NR)

Light DM through electronic recoil (ER)

Bosonic DM:

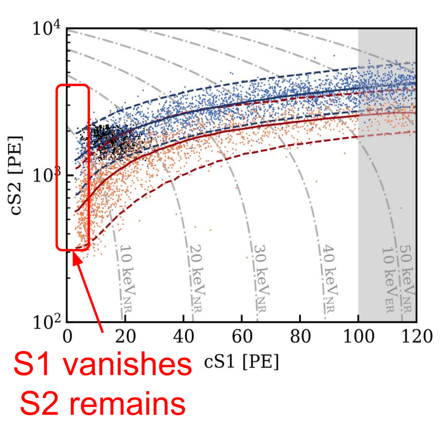
- Vector-boson DM: dark photons
  Arise from hidden sector, as a portal — mediator of interaction of ordinary matter and hidden sector
- Pseudoscalar DM: axion-like particles (ALPs)

⇒ can be absorbed by xenon atoms

S2-only analysis

- Detect events with recoil energy > 0.7 keV (0.186 keV) for NR (ER) instead of > 3.5 keV in S1-S2 analysis
- S2-only lowers the detectable energy threshold for 'light' dark matter at the expense of losing S1 (⇒ Lose event depth and associated cuts)

NR/ER: nuclear recoil/electronic recoil



S1 vanishes
S2 remains

Peak classification algorithm

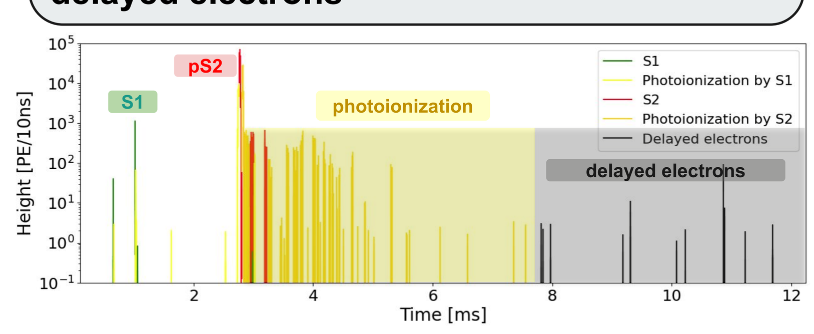
⇒ Pair S1 and primary S2

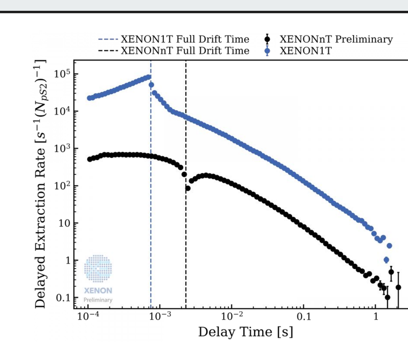
⇒ Pair primary S2 with photoionization and **delayed electrons**

Delayed electron train

⇒ follows a power law

⇒ length of removed time window

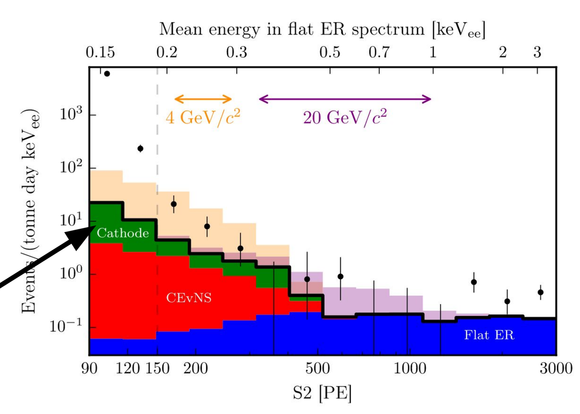




main background

After large S2	Photoionization; Delayed electrons	Removed by selection of search time window
Instrumental background	Cathode events; Impurities	Removed by selection
physical background	CEνNS (coherent nuclear scattering of ^{8}B solar neutrinos)	

Removed by data Construct background model



Background model

ER background from beta emitter (e.g. ^{214}Pb)

CEνNS using expectation value

Cathode events using estimated value in cathode dominant region